JPRS 68949

18 April 1977

USSR

EAST EUROPE

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

ENGINEERING AND EQUIPMENT

No. 31

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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 68949	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - ENGINEERING AND EQUIPMENT, No. 31			5. Report Date 18 April 1977 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts

The report contains abstracts and news items on aeronautical, marine, mechanical, automotive, civil and industrial engineering, related research and development, and engineering materials and equipment.

17. Key Words and Document Analysis. 17a. Descriptors

USSR
Eastern Europe
Aeronautics
Industrial Engineering
Marine Engineering
Stress Analysis
Turbines
Metrology

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 1A, 13H, 13J, 14B

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 164
	20. Security Class (This Page UNCLASSIFIED	22. Price A08

JPRS 68949

18 April 1977

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

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This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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UDC 541.24:532.5

NOISE SPECTRUM OF HYDRODYNAMIC CAVITATION IN THE PRESENCE OF A HARMONIC SOUND FIELD

VESTNIK MOSKOVSKOGO UNIVERSITETA. FIZIKA, ASTRONOMIYA in Russian Vol 17, No 2, 1976 pp 217-219

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B829 by V. A. Krasil'nikov]

YESIPOV, I. B., and KOZYAYEV, I. F.

[Text] The paper describes experiments on the influence that an external harmonic sound field (with frequency of about 3 kHz and pressure level up to 1000 dynes/cm^2) has on the noise spectrum of hydrodynamic cavitation that arises in a submerged jet (water) at a jet speed of up to 20 m/s. A cavitating horizontal jet has bubbles of different diameters; the spectral and integral characteristics of cavitation noise are determined by sound emission from these volumetrically pulsating bubbles (the output diameter of the jet nozzle is 2.5 cm).

In the experiments (the jet passed through a cylindrical sound emitter) an increase was observed in the spectral level of cavitation noise in the vicinity of the natural oscillations of the bubbles, where the frequency of oscillations of the bubbles corresponds to the frequency of the stimulating field. An interpretation is given for the observed phenomenon.

USSR UDC 532.526.3

COOLING OF THE SURFACE AND TRANSITION OF A LAMINAR BOUNDARY LAYER TO A TURBULENT BOUNDARY LAYER AT SUPERSONIC FLOW SPEEDS

AEROMEKHANIKA in Russian Moscow, Nauka Press 1976, pp 164-170

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 10, 1976 Abstract No 10.34.53 from the resume]

ALEKSEYEV, M. A., KUZ'MINSKIY, V. A., RAGULIN, N. F., and SHVALEV, YU. G.

[Text] Results are presented from an experimental study of the influence of surface cooling on the transition of a laminar boundary layer to a turbulent boundary layer in models of a straight wing and body of rotation with an ogival nose portion in a supersonic wind tunnel at flow velocities corresponding to M number os 3, 3.5 and 4 in the range of Reynold's numbers per m of length of $18 \cdot 10^6$ to $40 \cdot 10^6$. Figures 7; References 4.

USSR UDC 629.78.015:533.6.011.5

INFLUENCE OF ACOUSTICAL PERTURBATIONS ON TRANSITION OF A LAMINAR BOUNDARY LAYER TO A TURBULENT LAYER AT SUPERSONIC VELOCITIES

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian Vol 7, No 3, 1976 pp 32-38

[From REFERATIVNYY ZHURNAL, RAKETOSTROYENIYE No 12, 1976 Abstract No 12.41.125 from the resume]

BARINOV, V. A., VEDENEYEV, V. B., and MOZOL'KOV, A. S.

[Text] Results are presented from an experimental study of the transition of a laminar boundary layer to a turbulent boundary layer over a plate as a function of the point of installation of the plate along the length of the wind tunnel. Studies were performed at Mach numbers of 2, 3 and 4 and Reynold's numbers $Re_{1M}=(33-56) \cdot 10^6$. A description is presented of the model of formation and distribution of perturbations over the length of the working sector. Based on this model, formulas are produced which approximate the experimental values of Re number of beginning and end of transition area with an accuracy of 15%. Figures 5; References 7.

USSR UDC 541.24:532.5

PARAMETRIC METHOD OF CALCULATION OF THERMODYNAMIC AND TRANSFER PROPERTIES OF HIGH TEMPERATURE AIR

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 24-30

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B723 by V. A. Polyanskiy]

GLEBOV, G. A., and KOSHKIN, V. K.

[Text] A method is presented for calculation of thermodynamic properties of air (enthalpy and effective heat capacity) with known composition. A table of values of enthalpy and effective heat capacity of air at constant pressure is presented as a function of temperature. Comparison with known results shows good accuracy of the method suggested. The viscosity, heat conductivity and so-called chemical heat conductivity of air are also calculated in the 10^3-10^4 K temperature range.

USSR UDC 541.24:532.5

PARAMETRIC METHOD OF CALCULATION OF THE COMPOSITION OF HIGH TEMPERATURE AIR

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 17-24

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B720 by A. I. Golubev]

GLEBOV, G. A., and KOSHKIN, V. K.

[Text] A description is presented of a method of calculating the composition and thermodynamic functions of air, allowing rapid calculation of the necessary characteristics. The method is based on solution of a system of algebraic equations of thermochemical equilibrium, balance of the elements and electroneutrality using an iterational method and a computer. The method is compared with the method of predominant components. It is noted that the new method converges significantly more rapidly. The results of calculation of the composition of high temperature air by the two methods, presented in the form of tables for pressures of 1-100 bar and temperatures of 100-20,000 K agree completely.

USSR UDC 532.526

THE QUESTION OF THE INFLUENCE OF THE TEMPERATURE FACTOR ON HEAT EXCHANGE OVER A ROUGH SURFACE

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 9-12

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B164 by V. G. Shakhov]

KRYUKOV, V. N., and SOLNTSEV, V. P.

[Text] Experimental studies are performed in a subsonic wind tunnel on a disc 800 mm in diameter set perpendicular to the stream. The roughness consists of circular projections of trapezoidal cross section 1.87 mm in height. Therefore, a portion of the surface of the disc has a sector with full manifestation of roughness. The temperature factor varies between 0.4 and 0.9. The experimental data are approximated by an exponential function of the local Reynolds number with an exponent of 0.8 and a temperature factor, the mean value of the exponent of which was 0.53.

USSR UDC 532.526

EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF SLIT SUCTION ON THE FLOW IN A LAMINAR BOUNDARY LAYER

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 p 111

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B161 by V. A. Barinov]

KOZLOV, V. V., LEVCHENKO, V. YA., MAKSIMOV, V. P., RUDNITSKIY, A. L., and SHCHERBAKOV, V. A.

[Text] An experiment was conducted in a wind tunnel on a flat plate at a current velocity of 6.2 and 10 m/sec. A slit, 0.58 mm in width, was placed at a distance of 498 mm from the nose. The velocity profiles in the boundary layer were measured by a laser anemometer. The Reynolds numbers, determined from the flow velocity in the slit and width of the slit, were equal to 52 and 106; measurements were made both in the immediate vicinity of the slit ($x = -0.29 - 2.3$ mm) and at a slight distance from it upward along the stream to $x = -50$ mm.

USSR UDC 532.526

EXPERIMENTAL INVESTIGATION OF THE LAMINAR BOUNDARY LAYER BEHIND A LEDGE

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 109-110

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B167 by V. A. Barinov]

SHCHERBAKOV, V. A.

[Text] The author investigates the influence of two-dimensional elements of roughness on flow in an incompressible boundary layer and on the transition to the turbulent flow regime. In the velocity range from 5 to 20 m/sec he measures the velocity profiles in the boundary layer behind the ledge, about 1.8 mm high, and also determines the development of artificially created small perturbations. The tests were made on a flat plate. The results of the measurements demonstrated that the influence of the ledge is spread upward along the stream and downward along the stream to a distance up to 50 mm from the ledge; here behind the ledge there is a separation zone with an expanse of 30 mm. The author gives the dimensionless velocity profiles behind the ledge at a velocity of 7.3 m/sec in cross sections at a distance of 35, 50, 60, and 75 mm from the ledge. He also gives the results of measurements of the neutral frequencies of the artificially created perturbations and compares them with the computed ones.

USSR UDC 532.526

ESTIMATE OF EIGENVALUES FOR THE ORR-SOMMERFELD EQUATION WITH DISCONTINUOUS COEFFICIENTS

CHISL. METODY MEKH. SPLOSH. SREDY in Russian Vol 7, No 2, Novosibirsk 1976 pp 118-133

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B145 by S. Ya. Gertsenshteyn]

SLEPTSOV, A. G.

[Text] A study is made of the stability of a boundary layer consisting of two layers of incompressible fluid. At the division boundary of the fluids, the usual mating conditions are set. Estimates are produced for eigenvalues for the Orr-Sommerfeld equation when there are discontinuities in the derivatives of the velocity profile U(y) and the coefficient αRe, where α

is the wave number, Re is the Reynolds number. Furthermore, known estimates for the Orr-Sommerfeld equation with discontinuous coefficients are somewhat improved for high values of wave number.

The method of local colocation is also used in this work to perform direct numerical investigations in which the estimates of eigenvalues are essentially used.

USSR UDC 532.526

STRUCTURE OF A TURBULENT BOUNDARY LAYER UPON STREAM ACCELERATION

TRUDY AN LITSSR [Works of the Academy of Sciences Lithuanian SSR] in Russian Series B, No 6(91), 1975 pp 93-103

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B170 by the authors]

PYADISHYUS, A. A., ZHALYAUSKAS, A. B., and SHLANCHYAUSKAS, A. A.

[Text] The experimental investigations were conducted with the parameter of the pressure gradient $K = (\nu/u_\infty^2)du_\infty/dx \lesssim 6.6\cdot10^{-6}$. The authors show the deformation of flow along the acceleration zone for $k > 3.5 \times 10^{-6}$, including the increase in region of viscous flow, degeneration of the outer zone of the boundary layer in view of the decrease in gradient of velocity and intensity of pulsations, weakening of the intermittence and disappearance of a sharp boundary between the free stream and the boundary layer. They cite the results of comparing the obtained data with the computation by allowing for the convective terms of transport near the wall. References 8.

USSR UDC 532.526

ANALYSIS OF THE TURBULENT BOUNDARY LAYER WITH VARIABLE PHYSICAL PROPERTIES OF THE STREAM. I. THEORETICAL INVESTIGATION

TRUDY AN LITSSR [Works of the Academy of Sciences Lithuanian SSR] in Russian, Series B, No 6(91), 1975 pp 105-113

TAMONIS, M. M., DAGIS, L. I., and ZHUKAUSKAS, A. A.

[Text] The authors suggest a procedure for the numerical solution to a system of equations of a turbulent boundary layer with constant and

variable stream properties. The commonly known system of differential equations of a two-dimensional turbulent layer with variable physical properties of the stream was solved by the introduction of the current function in the form of a velocity deficit and a dimensionless coordinate which takes into account the change in density across the boundary layer. To describe the turbulent transport of the amount of movement and heat they use the Prandtl hypothesis of the length of the mixing path. For the constant physical properties of the turbulent stream the problem was solved numerically for $Re_x = 10^4 - 10^{12}$, $Pr = 0.25 - 1.5$, $Pr_t = 0.4 - 1.0$, and $K = 0.07 - 0.14$. The obtained results of the computation demonstrated the necessity of taking into account the size of the constant of proportionality of the length of the mixing path in the outer part of the boundary layer ($K = 1/\sigma$) and the turbulent Prandtl number during the computations and upon generalization of the experimental results of the resistance of friction and heat exchange. References 8.

USSR UDC 534.2:532

INFLUENCE OF THE SHAPE OF A BODY OF ROTATION ON THE INTENSITY OF SONIC SHOCK IN THE REMOTE ZONE

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 189-192

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B248 by O. K. Rozanov]

VOLKOV, V. F., CHIRKASHENKO, V. F., and YUDINTSEV, YU. N.

[Text] The authors experimentally investigate the influence of the shape of a blunt body on the intensity and character of the impulse of a sonic shock in the remote zone. They examine a series of shapes with different dependences of pressure distribution over the body, but with identical total wave resistance. Analysis of the field of flows both near the body of rotation and in the remote field was made on the basis of measurements of the profiles of excess pressures at a fixed distance from the model in a supersonic wind tunnel (they used the T-325 tunnel developed by the Institute of Theoretical and Applied Mechanics of the Siberian Branch of the Academy of Sciences USSR) and by extrapolation of the experimental data to great distances. With Mach numbers of the approaching stream of M - 2.02 they studied bodies with a wave resistance of c_x approximately equal to 0.11 (power body, hyperboloid of rotation, sharp and blunt cones). With M = 4,004 the wave resistance of three shapes of the bodies (sharp cones were not tested) was equal to 0.13. They established that with moderate supersonic Mach numbers thin blunt bodies may ensure a

significant decrease in intensity and impulse of the sonic block in comparison with thin sharp bodies possessing the same wave resistance. With increase in the Mach number the influence of the shape of the body of rotation on the parameters of the sonic shock in the remote zone is significantly reduced; the basic role begins to be played by the wave resistance rather than the character of the distribution of pressure along the length of the body. Thus, computations demonstrate that for the three indicated shapes of a body the intensities of the leading jump in the remote zone differ by only 10%. References 8.

USSR UDC 533.69.011

DISCRETE EDDY SCHEME IN THE CASE OF NONFLAT WINGS

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 161-163

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1088 by V. I. Putyata]

VOROB'YEV, N. F.

[Text] In developing a previous work, which examines one of the versions of a discrete eddy scheme in the nonlinear theory of a bearing surface (see AEROFIZICHESKIYE ISSLEDOVANIYA, Novosibirsk, REFERATIVNYY ZHURNAL, MEKHANIKA, No 5, 1973, Abstract No 5B272) the author shows that at the limit with an unlimited growth in the amount of discrete eddies, approximating the bearing surface with allowance of computing certain improper intervals in the sense of their main value, the induced velocity in all internal points tends to a finite value. References 6.

USSR UDC 533.69.011

DIALOG GRAPH IN A NUMERICAL INVESTIGATION OF WINGS IN THE SYSTEM MINSK-32 COMPUTER - DEL'TA GRAPHIC DIALOG CONSTRUCTOR

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 180-183

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1089 by V. I. Putyata]

BOKOVIKOV, YU. G., and RODIONOV, YU. I.

[Text] In development of a previous work (see Avtometriya, No 4, 1974 pp 121-123, REFERATIVNYY ZHURNAL, MEKHANIKA No 3, 1975 Abstract No 3B497) the authors discuss several results of seeking the best utilization of means and possibilities of graphic interaction between man and machine for a numerical investigation of the aerodynamic characteristics of wings. They demonstrate that the system created for the numerical investigation of wings with the aid of a graphic dialog constructor - computer may replace the experimental parametric treatment of models of wings of supersonic aircraft in a wind tunnel. References 5.

USSR UDC 533.697

CHOKING CHARACTERISTICS OF AN AIR INTAKE AT MACH NUMBERS EQUAL TO 1.75 - 6

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 238-241

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1145 by V. I. Bogomazov]

GOL'DFEL'D, M. A., ZATOLOKA, V. V., and TYUTINA, E. G.

[Text] The authors tested a model of a schematic air intake for a supersonic airplane with subsonic velocity in the control cross section (at the intake to the engine) for the purpose of obtaining the choking characteristics and field of total pressures in this cross section at Mach numbers M_n = 1.75 - 6, angles of attack α = 0° - 9° in the range of unit Reynolds numbers Re_{1M} = (10 - 60) x 10^6 1/m (for M_n = 5 and 6 with underheating of the air to 250°). They investigated the choking device with an electric drive which guarantees obtaining the choking characteristics with frequency of the experimental points and good repeatability of the data in the forward and reverse operation. The convergence of the experimental values

of the maximum coefficients of flow rate and recovery of the total pressure with the computed ones is satisfactory since no allowance was made in the computation for the flowing, nonuniformity of the field of velocities in the inner channel nor possible separation of the boundary layer.

USSR UDC 533.697

PSEUDODISCONTINUITY IN THE SIMPLEST AIR INTAKE IN THE FORM OF A CYLINDRICAL PIPE

UCHENYYE ZAPISKI TSENTRAL'NOGO AERO-GIDRODINAMICHESKOGO INSTITUTA [Scientific Annals of the Central Aerohydrodynamic Institute] in Russian Vol 7, No 1, 1976 pp 130-138

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1151 by resume]

GURYLEV, V. G., and TRIFONOV, A. K.

[Text] In the range of numbers M = 1.6 - 5 and Re = (1 - 6) x 10^6 the authors investigate a pseudodiscontinuity in the simplest air intake made in the form of a cylindrical pipe with a length of l = (3 - 15)d and a sharp trailing edge. They examine the phenomenon of fixation of the pseudodiscontinuity at the trailing edge arising at numbers M greater than or equal to 2. They demonstrate that here the length of the pseudodiscontinuity depends on the degree of choking of the channel and may be decreased by several times in comparison with the initial length in a flow without fixation. Pumping and turbulization of the boundary layer facilitate fixation of the pseudodiscontinuity at places where the pumping and turbulizer openings are located. References 7.

USSR UDC 621.375.82

CHANGE OF THE AMPLIFICATION FACTOR IN A SHOCK LAYER WHEN BLUNT BODIES ARE STREAMLINED BY A SUPERSONIC FLOW WITH INVERSE POPULATION DENSITY

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 13-20 manuscript received 6 Oct 75

YEGOROV, B. V., KOMAROV, V. N., and SAYAPIN, G. N., Moscow

[Abstract] In this paper a study is made of the change in the amplification factor when blunt bodies are streamlined by a relaxing gas, both in the

supersonic and subsonic regions of the shock layer, when the angle of inclination of the shock wave with respect to the direction of the inflowing stream changes from 90° to the Mach angle. A study is made of the influence of slight disturbances extended over an inverse medium on the amplification factor. In modeling a real flow of a relaxing gas under these conditions wide use is made of gas mixtures obtained by burning hydrocarbon fuels and containing molecules of CO_2, N_2, O_2, and H_2O. Of special interest in modeling problems is streamlining of bodies by a non-equilibrium flow with inverse population density of CO_2-molecule vibrational levels. Here a study is made of the behavior of the amplification factor of a weak signal in the shock layer when blunt bodies are streamlined by a non-viscous flow of a relaxing mixture of CO_2, N_2, and H_2O in the gaseous state, with inverse population density for $(00^01) - (10^00)$ vibrational-rotary transitions of the CO_2 molecule. It is demonstrated by calculation that if the conditions of a medium with inverse population density in the inflowing stream are conducive to increasing the amplification factor of a weak signal in the leading edge of the shock wave, then with low wave intensity in the shock layer there exists a sufficiently extensive zone with increased gain. Results are given of an analytical study of the change in gain under the effect of slight disturbances extended over an inverse medium. It is demonstrated that, depending on the value of the rotary quantum number in a weak shock wave or low-pressure wave, both an increase in gain and attenuation can take place. Figures 4; References 8: (Russian).

USSR

METHOD OF DEFORMED COORDINATES IN THE PROBLEM OF STREAMLINING OF A WING BY A SUPERSONIC FLOW OF GAS

Moscow AERODINAMIKA in Russian 1976 pp 32-39

[From Moscow REF ZH 41. RAKETOSTROYENIYE No 11, 1976 #11.41.136]

KUSAKIN, S. I., and PRITULO, M. F.

[Text] A substantially 3D field of flows near a wing of finite span, streamlined by a supersonic flow of gas is examined. A general type of feature of the solution of a linear equation is found which is the result of the breakup of the supersonic leading edge of the wind. The method of coordinate deformation is employed so that the cone of perturbation and the characteristic surface are combined. Only one coordinate is deformed. A uniformly precise solution of a nonlinear differential equation is constructed for the additional velocity potential. Illustrations 5; References 3.

USSR UDC 532.526

FLOW IN THE VICINITY OF THE POINT OF ORIGIN OF INTENSE SUCTION OF A LAMINAR BOUNDARY LAYER IN A SUPERSONIC STREAM

UCHENYYE ZAPISKI TSENTRAL'NOGO AERO-GIDRODINAMICHESKOGO INSTITUTA [Scientific Annals of the Central Aerohydrodynamics Institute] in Russian Vol 7, No 2, 1976 pp 37-44

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B126 (resume)]

LIPATOV, I. I.

[Text] An investigation is made of flow in the vicinity of the point of origin of intense suction of a laminar boundary layer on a plate in a supersonic stream. Equations and boundary conditions are derived that describe this flow, and an asymptotic solution is found when $Re \to \infty$, $\nu_\omega \to 0$. The types of flow that arise are classified as a function of the relation between the parameters Re and ν_ω. It is shown that the onset and cessation of intense suction leads to unfavorable high localized pressure gradients, but not to separation of the boundary layer. References 6.

USSR UDC 532.526

SURFACE COOLING AND LAMINAR-TO-TURBULENT BOUNDARY LAYER TRANSITION AT SUPERSONIC FLOWRATES

Moscow AEROMEKHANIKA [Aeromechanics, Collection of Papers] in Russian, "Nauka," 1976 pp 118-140

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B137 by the authors]

ALEKSEYEV, M. A., KUZ'MINSKIY, V. A., RAGULIN, N. F., and SHVALEV, YU. G.

[Text] The paper gives the results of an experimental study of the influence that surface cooling has on the laminar-to-turbulent boundary layer transition on models of a straight wing and solids of revolution with ogive nose in a supersonic wind tunnel at flowrates corresponding to Mach numbers of 3, 3.5 and 4 in the range of Reynolds numbers from $18 \cdot 10^6$ to $40 \cdot 10^6$ per meter of length.

USSR

UDC 533

CONCERNING MECHANISMS OF AMPLIFICATION AND ABSORPTION OF EMISSION IN PROBLEMS OF RELAXATION GASDYNAMICS

Novosibirsk TRUDY TRET'YEGO VSESOYUZNOGO SEMINARA PO MODELYAM MEKHANIKI SPLOSHNOY SREDY [Transactions of the Third All-Union Seminar on Models in the Mechanism of Continuous Media] in Russian 1976 pp 79-103

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B198 by Yu. P. Lun'kin]

KUZNETSOV, V. M.

[Text] This survey examines a number of nonequilibrium flows and the mechanisms of amplification and absorption of emission that are observed with these flows. Chiefly investigated are CO_2 gas dynamic lasers with the generally accepted kinetics of population inversion.

Population inversion may arise when the gas expands in nozzles and in nozzle cascades, and also with external expansion in Prandtl-Meyer flow and flow around blunt bodies, with gas compression on a shock wave front in the case of external and internal flows and in one-dimensional unsteady motion of gas displaced by a piston, in two-phase flows that contain solid or liquid aerosols on which "surface" oscillatory relaxation occurs and with mixing of gas jets.

The paper gives the results of research relating to these types of flow, and an analysis of the influence that initial conditions have on the magnitude and distribution of population inversion in the flow.

An examination is also made of the influence of turbulent pulsations on power loss in gas dynamic lasers and the interaction of external laser emission with gas dynamic flow based on the example of a laminar boundary layer. References 44.

USSR

UDC 541.24:532.5

AN EXPERIMENTAL STUDY OF NONEQUILIBRIUM CHEMICAL REACTIONS IN THE MIXING ZONE OF AN ISOBARIC JET

[TRUDY] MOSKOVSKOGO AVIATSIONNOGO INSTITUTA [(Transactions) of Moscow Aviation Institute] in Russian No 351, 1976 pp 12-17

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B862 (from the paper)]

RUSKOL, V. A., and SAPRYKIN, A. A.

[Text] An experimental study is done on the parameters of a turbulent isobaric submerged jet of products of combustion of organic fuel in the

presence of nonequilibrium reactions in the mixing zone. A nonequilibrium chemical process is defined as one for which the characteristic time is comparable with the characteristic gasdynamic time.

The following determining parameters were varied in the experiment: characteristic rate equal to the rate on the axis in the initial section; characteristic temperature equal to the temperature on the axis in the initial section; pressure and composition of the gas in the initial section; degree of nonuniformity of the initial temperature profile.

USSR UDC 629.761.78.015:533.6

PRESSURE DISTRIBUTION ON SHARP CONES AT ANGLES OF ATTACK α = 0-10° IN A SUPERSONIC FLOW

UCHENYYE ZAPISKI TSENTRAL'NOGO AERO-GIDRODINAMICHESKOGO INSTITUTA [Scientific Annals of the Central Aerohydrodynamics Institute] in Russian Vol 7, No 2, 1976 pp 163-166

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B1214 (resume)]

LEUTIN, P. G.

[Text] On the basis of experimental studies the author offers an empirical method of determining pressure on sharp cones with a semivertex angle θ_s=10-30° at angles of attack $\alpha \approx 0$-10° in a supersonic flow. The technique is based on using a scaling law for sharp cones at α=0, as well as linear variation in the pressure coefficient with respect to angles of attack in the meridional plane. References 8.

USSR UDC 533.697

HYPERSONIC FLOW IN A CONICAL CONSTRICTIVE CHANNEL

IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY. AVIATSIONNAYA TEKHNIKA in Russian No 2, 1976 pp 124-128

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B1223 by the authors]

DUGANOV, V. V., and POLYAKOV, V. V.

[Text] A flow of ideal gas with adiabatic exponent γ = 1.67 is calculated in a conical constrictive channel with sharp leading edge by a straight-through

method of computation for Mach numbers of the oncoming flow M_∞ = 5, 10, 15, 20, 25 and 35 at three fixed values of the hypersonic dimensionless number $K=M_\infty \tan\delta$=1, 2, 3, where δ is the semivertex angle of the tapered channel. It is shown that the theory of hypersonic scaling is valid for internal gas flow in such a channel when a system of oblique compression shocks is present in the flow. The error of conformity with the scaling law is no greater than 5% if the localized values of the Mach number in the channel exceed 4.

USSR UDC 621.43.011:533;621.5:533

INTERACTION OF AN UNDEREXPANDED JET WITH A FLAT BARRIER IN A SUPERSONIC WAKE

Novosibirsk AEROFIZICHESKIYE ISSLEOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 192-194

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1179 by V. I. Bogomazov]

LOKOTKO, A. V., SOBOLEV, A. V., SOLOTCHIN, A. V., and SHEVCHENKO, V. N.

[Text] The authors conducted experimental investigations on models consisting of a nozzle and a flat barrier for the purpose of clarifying the character of the interaction of the underexpanded jet with the barrier in a supersonic wake and obtaining the quantitative characteristics on the barrier. As the variables they used: the degree of noncomputation of the jet $n = P_a/P_\infty$ ($3 \leq n \leq 4.32$) and the distance from the nozzle cutoff to the barrier $\bar{x}_n = x_n/r_a$ ($3.6 \leq \bar{x}_n \leq 16.5$). The barrier which moves along the axis of the jet leads to a restructuring of the stream structure. Thus, for example, in the range of $7 \leq \bar{x}_n \leq 9$ the regime with a Mach configuration of the shock waves has an unstable central compression shock. They compare the character of the interaction of an underexpanded jet in flooded space. The experimental data agree well with the computation procedure for a flooded jet.

USSR UDC 533.69.011

STUDY OF COMPRESSION SHOCKS DURING A FLOW AROUND A PROFILE WITH RUDDERS BY THE METHOD OF GAS-HYDRAULIC ANALOGY

Tashkent SBORNIK NAUCHNYKH TRUDOV. TASHKENTNYY POLITEKHNICHESKIY INSTITUT [Collection of Scientific Works. Tashkent Polytechnic Institute] in Russian No 154, 1975 pp 1-8

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1095 by B. I. Bakum]

AMIR'YANTS, G. A., SADYMENKO, T. P., and YAKUBOV, I. R.

[Text] The authors present the results of investigations by the method of gas-hydraulic analogy on the character of the streamlining of a profile model with a mechanized nose and tail. The investigations were conducted in a hydraulic channel with pulling of the models in a fine fixed layer of liquid and encompassed the range of angles of attack $\alpha = 0° - 15°$, Mach numbers M = 1 - 19, angles of deflection of the nose $\delta_n = \pm(0° - 25°)$. Typical for the majority of cases was the presence of a bow shock, a local shock formed in the region of bending of the profile nose on the internal obtuse angle, and a tail shock. With increase in α they observed a shift in the local shock toward the rear edge of the profile, the angle of nose deflection, in which the shift began, being decreased with growth in α. The bow shocks during deflection of the nose upward were symmetrical relative to the profile, and with deflection downward -- nonsymmetrical. In the last case the authors observed a bending in the bow shock to the side of the local shock which increases with growth in α and δ_n. When $\alpha > 6°$ there was a closing of these shocks the point of their joining with growth in α being shifted closer to the profile. With increase in the Mach number the onset of a local shock on the rear bend was observed at smaller values of δ_n; here the angle of slope of the local shock was reduced. Deflection of the tail of the profile exerted practically no influence on the position and configuration of both the bow and the local shock on the breaking-off line.

USSR UDC 532.526

NUMERICAL INVESTIGATION OF THE INFLUENCE OF LOCAL HETEROGENEITIES ON THE FLOW OF A VISCOUS INCOMPRESSIBLE GAS

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 118-121

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B154 by V. A. Barinov]

MAKSIMOV, V. P.

[Text] In the framework of the Navier-Stokes equation the author investigates the flow near a slit with suction and blowing and near a ledge. Both problems are solved by the finite-difference method. The computations were made for several values of the amount of suction (Re_{slit} = 60 and 100) and blowing (Re_{slit} = 40) and with one value of the size of the ledge h/L = 0.002. The author gives the distribution of static pressure over the thickness of the boundary layer in the vicinity of the slit and ledge and the profiles of the longitudinal and transverse velocity components in several cross sections of x.

USSR UDC 533.601.18

FLOW OF DIATOMIC GAS PAST A SPHERE BASED ON KINETIC EQUATIONS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 227, No 1, 1976 pp 60-62

LARINA, I. N., and RYKOV, V. A., Computer Center, USSR Academy of Sciences, Moscow

[Abstract] To describe the flow of a diatomic gas past a sphere, use is made of a distribution function f(t, r, ξ, e), dependent on time t, radius of vector r, velocity of center of inertia ξ and the energy of rotational motion of the molecule e. The distribution function of molecules reflected from the surface of the sphere is given as an equilibrium distribution with temperature equal to the sphere's temperature T_w. Calculations show that the existence of internal degrees of freedom, especially when they number at least three, weakly affects the transfer of momentum to the body past which the flow occurs.

USSR UDC 533.6.011

THREE-DIMENSIONAL STEADY GAS FLOWS WITH DIRECT LEVEL LINES IN THE PRESENCE OF A BERNOULLI INTEGRAL

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 227, No 1, 1976 pp 57-59

ZUBOV, YE. N., Institute of Mathematics and Mechanics, Urals Scientific Center, USSR Academy of Sciences

[Abstract] A full classification of three-dimensional steady flows with direct level lines in the presence of a Bernoulli integral is given. When the adiabatic index is 2, it is shown there exists a class of supersonic vortex flows dependent on two arbitrary functions of one variable.

USSR UDC 532.517.4

THE INFLUENCE OF TURBULENCE OF A STREAM ON ESCAPE OF PARTICLES

AERODINAMIKA POGRANICH. SLOYA in Russian, Tashkent, Fan Press 1976 pp 3-5

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B131 by E. Ya. Epik]

ISMAILOV, M. I., AZIZOV, A., and KADYROV, KH. G.

[Text] An experimental study is made of the escape of particles 0.06-5 mm in diameter in a stream with small-scale turbulence created by grids with an intensity of turbulence of 0.13-0.35%. It is shown that as turbulence increases, the critical particle escape velocities increase, the change in turbulence having an influence with diameters of less than 0.1 mm.

USSR UDC 629.78.062.2.001

STUDY OF PLANNING AND DESIGN OF CYBERNETICS HARDWARE, ELECTRONIC SYSTEMS AND FLIGHT VEHICLE INSTALLATIONS

[TR.] MOSK. AVIATS. IN-TA in Russian No 348, Moscow 1976 107 pp

[From REFERATIVNYY ZHURNAL, RAKETOSTROYENIYE No 12, 1976 Abstract No 12.41.193 K from the resume]

KOZLOV, V. I., and PROTOPOPOV, A. S., [Editors]

[Text] Problems of the synthesis of a control algorithm for the motion of a flight vehicle, identification of control objects in the process of

flight testing and normal operation using computers, of navigation, orientation and stabilization of flight vehicles, as well as problems of development of individual elements of control systems are discussed. A study is made of investigations on the optimization of signal processing systems and separation of signals from noise. The collection can be used by engineers, graduate students and students in the higher university levels working on the creation of modern automatic and electronic systems.

USSR UDC 534.222.2:537.84

THE FLOW BEHIND THE LEADING EDGE OF A DETONATION WAVE IN A TRANSVERSE MAGNETIC FIELD AT LOW Re_m

SB. TR. N.-I.ENERG. IN-T IM. G. M. KRZHIZHANOVSKOGO in Russian 1975 No 36 pp 71-78

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 10, 1976 Abstract No 10.34.174 from the resume]

KUZNETSOV, A. P., PLESHANOV, A. S.

[Text] A non-self-similar problem of flow in the rarefaction wave of an ideally conducting gas behind a Chapman-Jouguet detonation wave at the closed end of a pipe in a transverse magnetic field with zero electric field is stated and numerically solved by the method of characteristics. It is shown that a compression wave is formed in the rarefaction wave, moving away from the leading edge of the detonation wave. The gradients of all quantities increase at the leading edge, in the case of the variable conductivity the change in all quantities is localized at the leading edge. With sufficiently long-term action of the magnetic field in the portion of the rarefaction wave adjacent to the quiescent gas an area of reverse flow appears. Figures 9; References 2.

USSR UDC 629.78.051

A NOMOGRAM FOR CALCULATION OF THE RELATIVE BEARING OF A CELESTIAL BODY

TR. LENINGR. IN-TA TOCHNOY MEKH. I OPTIKI in Russian 1976 No 84, pp 106-108

[From REFERATIVNYY ZHURNAL, RAKETOSTROYENIYE No 12, 1976 Abstract No 12.41.195 by T.A.Ye.]

LEONOV, V. N.

[Text] A study is made of a method of determining the relative bearing Q of a celestial body when taking the bearing of the body from a moving platform.

The method provides, under certain conditions, for elimination of the error ΔQ resulting from inclination of the astrosextant relative to the true horizon. The essence of the method consists in that the object is used to measure the bearing q and altitude of the body h at the moment in time when the bank or pitch angle of the platform is equal to zero. Then the relative bearing of the body Q is determined from the equations sinQcosH=sinqcosh and cosQcosH=cosqcos h, where H is the altitude of the body calculated at the moment of observation from the known position of the object. A method is shown for determination of the relative bearing Q using a nomogram. Based on analysis of the nomogram, the following conclusion is reached: when there is an error in determination of H, h, the accuracy of calculation of Q from the first equation in various portions of the nomogram is different, since the tangents to the lines of the nomogram have different angles of inclination to the axes of the rectangular system of coordinates. The least error in determination of Q is provided by observation of a body with small values of H and h at angles q and Q near 0 or 180°. In order to calculate Q from the second equation, angles q and Q must be near 90 or 270°. Similar results are produced upon analytic analysis of the error in determination of Q using the first and second equations. References 2.

USSR

UDC 533.697

DAMPING FACTOR WITH INTENSIVE RESONANT OSCILLATIONS OF A GAS STREAM IN CHANNELS

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 60-64

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B1059 by V. I. Bogomazov]

GALITSEYSKIY, B. M., KOSHKIN, V. K., NOZDRIN, A. A., and YAKUSH, YE. V.

[Text] Results are presented from an experimental study of the damping factor in two heated cylindrical channels with internal diameters of 12 and 19.4 mm respectively and lengths of 2.045 and 2.337 m. The working gas used is air. The experiments were performed with a temperature parameter on the wall of 1.1-1.5, Reynolds number $Re=10^4-10^5$, pressure in the channel $P_0=3.5-20$ bar, oscillating frequency 70-1000 Hz, amplitude of oscillation 0.1-3 bar. It is shown that the most significant parameters influencing the attenuation factor are the Reynolds number, oscillating amplitude, oscillating frequency and channel diameter.

USSR UDC 536.24

HEAT YIELD OF A BODY WITH NEAR FREE-MOLECULAR SUBSONIC FLOW AROUND IT

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 45-50

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B449 by Ye. P. Dyban]

KOSHMAROV, YU. A., and SVIRESHCHEVSKIY, S. G.

[Text] A study is made of stable flow around and heat yield by a sphere and a thin plate with a Mach number of the unperturbed flow $M<<1$ and temperature factor $t_w=T_w/T\approx 1$. An analysis is made of the case with negligible probability of secondary (and subsequent) collisions near the body of molecules of the unperturbed stream and molecules reflected by the surface. The velocity of reflected molecules is assumed to depend on the temperature of the surface, the collision of molecules is assumed to occur according to the law of collisions of elastic spheres. The heat flux density from the surface is defined as the difference in energies of molecules arriving to and departing from a unit surface area.

The semiempirical dependences produced, of the form $q/q_w=f(Kn)$ (where q is the heat flux density in the case in question, q_w -- the same with free molecular flow mode, Kn -- the Knudsen number) agree satisfactorily with the experimental data in the range $0.1<Kn<3$. References 6.

USSR UDC 533.6.011.8

MEASUREMENT OF THE BASIC PARAMETERS OF A HYPERSONIC RAREFIED JET WITH A STAGNATION TEMPERATURE $T_0=4000$-6000 K

VSES. SIMPOZ. PO METODAM AZROFIZ. ISSLED., 26-29 APR. TEZISY DOKL. in Russian Novosibirsk 1976 pp 58-59

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B277 by O. K. Rozanov]

ZHESTOKOV, B. YE., and ORLOVA, Z. T.

[Text] An experimental study is presented of parameters of nonequilibrium processes in a hypersonic rarefied jet. The jet was created upon exhaust of a gas heated in a high frequency heater through a sonic nozzle into a space with a pressure of about 0.1 Pa. A Pitot tube and specific flow rate fitting were used to measure the full head, specific flow rate and determine

the values of mean mass velocity and density in the jet. The values produced were compared with the results of measurements in a free molecular beam. The gas temperature in the prechamber and in the stream were measured by the calculation and spectroscopic methods and compared with the values of gas velocity. The distributions of rotary and oscillating temperatures in the stream are found. The population of rotary levels is studied for a number of bands in the first negative and second positive systems of nitrogen in the stream. Probes and spectral methods are used to determine the temperature of electrons and degree of gas ionization. It is noted that the results of measurement of the basic parameters agree among themselves.

USSR UDC 533.6.011.8

EXPERIMENTAL STUDY OF THE INTERACTION OF RAREFIED STREAMS ($E_0=10^3-10^4$ eV) WITH THE SURFACE LAYERS OF SOLIDS

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 55-60

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B270 by R. G. Barantsev]

GUSEV, K. I., MIKHEYEV, S. YU., and SHKARBAN, I. I.

[Text] This article presents a description of the installation and results of an experiment for measurement of the energy spectra of ions of inert gases penetrating through thin metal films. Results are presented for helium ions with initial energy $E_0=6$ and 7 KeV and films of silver with initial thickness 220 to 380 A. The distribution has a peak, and there is a small second peak created by doubly ionized atoms with the same energy. The mean energy losses are calculated. For $E_0=4$, 6 and 7 KeV they are 5.7, 8.25 and 6.82 eV/A respectively.

USSR UDC 533.6.011.8

ENERGY ACCOMMODATION FACTOR OF PARTICLES STRIKING THE SURFACE OF A SOLID AT $E_0=100-500$ eV

[TR.] MOSK. AVIATS. IN-TA in Russian No 351, 1976 pp 50-55

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B269 by R. G. Barantsev]

GUSEV, K. I., RYZHOV, YU. A., STRIZHENOV, D. S., and SHKARBAN, I. I.

[Text] The Einstein model of a crystalline lattice, used earlier for impact energies of 1-10 eV, is supplemented by properties intended to consider

phenomena related to increasing energy. In order to decrease the amplitude of oscillations of atoms in the crystal, the rigidity of the bonds is increased. To consider the nonharmonic nature of the process, an assigned force is added, bonding each atom in the lattice to the equilibrium position. Energy exchange within the lattice is regulated by a dissipative term. Proper selection of the dissipation factor with a slight increase in bond rigidity allows the production of a dependence of the accommodation factor on impact energy which agrees qualitatively with the experimental value. A decrease in the number of atoms in the lattice to 13-14 has no significant influence on the accommodation factor.

USSR UDC 533.95

PROPAGATION OF AN IONIZING MHD SHOCK WAVE IN AN INHOMOGENEOUS MEDIUM

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 46-50 manuscript received 12 Sep 75

ZAKAYDOV, V. V., ISAKOV, V. P., KIRKO, V. I., and SYNAKH, V. S., Novosibirsk

[Abstract] A study is made of the propagation of an ionizing MHD shock wave in a medium with magnetic field and density gradients, for two particular cases: When density is constant and the magnetic field increases in the direction of propagation of the front; and when the magnetic field is steady and density decreases in the same direction. The motion of ionizing MHD shock waves in an inhomogeneous medium is of interest in light of possible applications; for example, in experiments on acceleration of a shock wave in a gas with decreasing density or in a plasma with an inhomogeneous magnetic field, as well as in astrophysical studies of problems of the dynamics of cosmic plasma. The first case of the two studied here is examined experimentally. The apparatus is described and curves are shown, expressing the relationship between the intensity of the magnetic field behind the front of the shock wave at different moments of time, and magnetic field and temperature profiles behind the front of the shock wave at different moments of time for a gas with an ionization potential of about 13 eV and initial pressure of 50 mm Hg, e.g., hydrogen. It is demonstrated that the magnetic field is displaced in the region in front of an MHD shock wave. Displacement of the magnetic field and its dissipation behind the front leads to considerable gradients in the magnetic field behind the shock wave. In the second case, when density decreases in the direction of wave propagation and the magnetic field in front of the front is constant, there is an increase in the velocity of the front of substantially greater magnitude than in the first case. An earlier study in a homogeneous medium demonstrated that the magnetic field is almost totally displaced by an ionizing shock wave in this case also, thus providing a basis for suggesting that displacement of

magnetic flux is an inherent property of an ionizing shock wave under any conditions. Displacement of magnetic flux in the region ahead of the front of a shock wave can be used to obtain rapidly increasing magnetic field pulses. In the experiment conducted here the magnetic field was increased by a factor of 2.5 in 10 microseconds. Figures 4; References 13: 11 Russian, 2 Western.

USSR UDC 531.55:521.1

CONCERNING TWO-DIMENSIONAL PERTURBED MOTION OF AN ARTIFICIAL SATELLITE WITH MAGNETIC DAMPER RELATIVE TO ITS CENTER OF MASS

SBORNIK RABOT PO TEORII OPTIMAL'NYKH PROTSESSOV. KALININGRADSKIY UNIVERSITET [Collected Papers on the Theory of Optimum Processes. Kaliningrad University] in Russian No 2, 1975 pp 214-239

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11A121 by the author]

LAVRINOVICH, K. K.

[Text] The paper examines nonlinear oscillations of an artificial satellite with magnetic damper in the plane of a circular polar orbit subjected to the action of gravitational and certain perturbing moments. An approximate solution is found by the method of averaging for nonresonant and resonant conditions. An analytical relation between amplitude and time is found for the case of nonresonant conditions. The possibility of steady-state motion is investigated in terms of the frequency and parameters of the system. It is shown that a damped oscillatory process is the only possible motion over a wide range of parameters of the system. References 8.

USSR UDC 629.78.015:532.526

APPROXIMATE APPROACH TO THE STUDY OF CHARACTERISTICS OF TWO-DIMENSIONAL LAMINAR BOUNDARY LAYER IN THE PRESENCE OF MASS-EXCHANGE ON THE SURFACE OF A BODY

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian 1976, 7, No 1, pp 97-101

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.86]

STEPANOV, E. A.

[Text] An approach is proposed which permits, on the basis of precise solutions to full boundary layer equations corresponding to some

mass-exchange distributive law, the approximate analysis of boundary layer characteristics for other mass-exchange conditions. Precision calculations may be done with any 2-parameter law, such as exponential. Results of calculations are cited for the case of flow around a circular cylinder by a stream of ideal gas. The results are compared with data obtained according to the method of local self-simulation. Illustrations 2; References 3.

USSR UDC 629.78.015:532.526

TURBULENT BOUNDARY LAYER ON A MOVING SURFACE

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian 1976, 7, No 1, pp 40-50

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.85]

GINEVSKIY, A. S., YEMEL'YANOVA, G. N., and KOLESNIKOV, A. V.

[Text] Methods are presented for calculation of a turbulent boundary layer on a moving surface in the presence of longitudinal pressure gradient under conditions where the velocity profiles remain monotonic. The latter restriction makes it possible to use models of turbulent viscosity which are officially accepted in calculations of boundary layer on a stationary surface. Two methods of calculation are considered: Modification of a single-parameter integral method based on polynomial approximation of the profile of tangential stress and a 2-layer scheme (viscous sublayer, turbulent nucleus), as well as a numerical method with more complex model of eddy viscosity, in which are considered the alternation in the outer portion of the layer and the effects of molecular and molar nature in the near-wall portion. Results of calculation are compared with experimental data, and both methods yield virtually congruent results. Illustrations 6; References 13.

USSR UDC 629.78.015:536.24

FREELY-CONVECTIVE HEAT EXCHANGE AND RESISTANCE OF A HORIZONTAL CYLINDER AND VERTICAL PLATE IN GAS MEDIA

Khabarovsk SAMOLETOSTROYENIYE I AVIATS. TEKHN. in Russian 1975 pp 97-104

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.87]

KOLYKHALOV, G. S.

[Text] A problem is formulated and solved concerning the natural-convective heat exchange and resistance of a horizontal cylinder and vertical plate

with a laminar boundary layer near the wall. The solution is carried out by the method of successive approximations allowing for the relationship of viscosity and density of the medium as a function of temperature and limited to two approximations. Criterial relationships are found for the coefficient of heat exchange and natural-convective resistance. References 6.

USSR UDC 629.78.076.6

APPROXIMATE ANALYTICAL CALCULATION OF INTERORBITAL PASSAGE WITH SOLAR SAIL UNDERGOING WEAR

Frunze TR. FRUNZ. POLITEKHN. in Russian In-ta 1975 vyp. 90, pp 142-145

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.76]

DZHUMANALIYEV, N. D., and KISELEV, N. D.

[Text] The problem posed in the works of F. A. Tsander concerning flight in near-earth and interplanetary space using solar wind tapped by a solar "sail," which makes it possible to generate control and correction forces without weight expenditure to fuel consumption, has been examined numerous times in the theoretical studies of various authors. These authors were limited only to an idealized statement of problems, assuming the surface of the solar sail to be ideally reflective. But the surface of any actual material has a coefficient of light reflection r of less than unity. The use of a solar sail, i.e., a flat extended reflecting screen, under orbital conditions, where its surface will be affected by factors such as the extreme vacuum, micrometeors, corpuscular fluxes, high energy gamma emission, and others of outer space, cause a gradual deterioration in its optical characteristics. It is possible not only to reduce the coefficient of reflection, but there may be a gradual increase in the sail transparency or permeability. Equations are presented for motion of a solar sail. After substitution the equations yield a linear differential equation which is immediately integrated: this yields an approximate solution for interorbital passage. The main effect described by this solution is the continuous decrease in the spacing of the spiral, which is the trajectory of flight with a solar sail. The calculations ignore sail-generated forces resulting from liberation of gases from its surface, but these methods may be extended to the case of erosion of a solarsail whose efficiency decreases in direct proportion to gradual depletion of the erosion layer. References 8.

USSR UDC 629.78.017.2

ON THE STABILITY OF DEGENERATED PERMANENT REVOLUTIONS OF A SOLID BODY

Kazan TR. KAZAN. AVIATS. IN-TA in Russian 1975, vyp 169, pp 14-19

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.80]

IRTEGOV, V. D.

[Text] A classification of facets of stationary motions as features of some Legendre transformation is cited. The stability of one class of degenerated permanent revolutions of a body having a stationary point within Lyapunov's second method is studied. References 5.

USSR UDC 629.78.007

MENTAL/PHYSIOLOGICAL FACETS OF ASTRONAUT VISION AS A FUNCTION OF ILLUMINATION AND LIGHTING TECHNIQUE

KIBERNET. I VYCHISL. TEKHN. RESP. MEZHVED. SB. in Russian 1976 vyp 32, pp 46-67

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 11, 1976 #11.41.279]

IVANOV, YE. A.

[Text] Analytical relationships and experimental data are provided for several applied examples, establishing a tie-in between mental-physiological capabilities of astronaut visual activity and illumination and lighting technique. Analysis of optimum and extreme levels of illumination can be done to determine appropriate levels for given astronaut visual activity. Illustrations 14; Table 1; References 12.

USSR UDC 629.78.017.2

ON PLANE PERTURBED MOTION WITH RESPECT TO THE CENTER OF MASS OF A SATELLITE HAVING A MAGNETIC DAMPER

SB. RABOT PO TEORII OPTIMAL'N. PROTSESSOV, KALININGR. UN-T in Russian 1975 vyp. 2, pp 214-239

[From Moscow REF. ZH 41. RAKETOSTROYENIYE No 11, 1976 #11.41.119]

LAVRINOVICH, K. K.

[Text] Nonlinear oscillations of space satellites having magnetic dampers in the plane of a circular polar orbit under the effect of gravitational and other perturbing moments. The approximate solution is constructed by the method of averaging for nonresonant and resonant conditions. For the case of nonresonant conditions, analytical relationships are drawn between amplitude and time. The possibility of occurrence of conditions of stationary resonance as a function of frequency and system parameters is studied. It is found that within a wide range of system parameter values the sole possible motion is a damping oscillatory process. References 8.

USSR UDC 629.78.017.2

THE USE OF LINEAR PROGRAMMING TO SOLVE THE SELECTION OF REQUIRED ENERGY RESERVES OF CONTROLLED OBJECTS

NEKOTOR. VOPR. DINAMIKI I UPR. DVIZHENIYEM, in Russian Kiev, 1976 pp 57-68

[From Moscow REF ZH 41. RAKETOSTROYENIYE No 11, 1976 #11.41.110]

DOLODARENKO, V. A.

[Text] The problem of selecting required energy reserves of standardized controlled objects is examined. These are used to deliver a useful load from a given set of starting points to a given set of end points with an allowance for starting points to designate any end point. Evaluation of problem's solution may be done on basis of providing to all objects sufficient energy for the greatest distance between starting and finish points. But this evaluation will generally yield an exaggerated result, since most distances between starts and finishes may be much less than the greatest. Using a sufficiently large number of points and probability theory, this fact takes into consideration the exaggeration in deriving the goal function. The statement of the problem is given in terms of combinatorial analysis and nonlinear integer programming. Analysis of the goal function made it possible to reduce the solution of this problem to a sequential solution of a series of problems of linear programming. This method may be used to

determine required reserves of energy of different controlled standard objects for which the transition from many given starting points to end points required energy consumption which does not exhaust the entire reserve. A goal function may be some functional which under nominal conditions associates energy consumption with reaching a given end state. References 7.

USSR UDC 629.78.017.2

ON THE OPTIMAL CONTROL OF ARTIFICIAL EARTH SATELLITE ANGULAR VELOCITY

SB. RABOT PO TEORII OPTIMAL'N. PROTSESSOV, KALININGR. UN-T in Russian 1975 2, pp 170-213

[From Moscow REF ZH 41. RAKETOSTROYENIYE No 11, 1976 #11.41.109]

NUMELLOV, L. I.

[Text] The issue of analyzing the optimum consumption of fuel for control of artificial earth satellite angular velocity is examined. To dampen angular velocity, methods of optimum control and the order of firing of rocket motors generating control momenta are presented. Formulas are derived for computation of fuel consumption with optimum control for satellites having three pairs of motors, generating positive and negative control momenta. Branches of control moments are considered unequal to each other. Analysis is performed on change in angular velocities when control is executed to different momenta.

USSR UDC 621.039.526.621.039.53.001.5

THE BASIC GOALS OF THE INTRAREACTOR STUDIES OF THE MECHANICAL PROPERTIES OF CONSTRUCTION MATERIALS REQUIRED TO DETERMINE THE FITNESS OF THE CORE ELEMENTS OF FAST POWER REACTORS

Kiev V. SB. RADIATSION. EFFEKTY IZMENENIYA MEKH. SVOYSTV KONSTRUKTS. MATERIALOV I METODY IKH ISSDEL. [Collection of Works: Radiation Effects of the Variation of the Mechanical Properties of the Construction Materials and Methods of Investigating Them] in Russian, Nauk. Dumka, 1976 pp 3-13

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11U193 by G. I. Korotkina]

LIKHACHEV, YU. I., PROSHKIN, A. A., and TUZOV, A. N.

[Text] The creation of the highly stressed fuel elements permitting the combustion of nuclear fuel to 10 percent of the heavy atoms is one of the principal problems of the development of the fast power reactors. The fuel assemblies and the fuel elements of these nuclear reactors are under very rigid conditions in operation: high energy released density (600 to 900 kilowatts/liter) gives heat fluxes from the jacket surface of 2 to 3 x 10^6 kcal/m^2-hr; the velocity of the heat transfer agent (as a rule, liquid metal Na, NaK) is 7 to 10 m/sec, and its temperature is from 300 to 350°C at the input and to 600-650°C at the output from the nuclear reactor core; the temperature on the jacket in this case is 300 to 350°C at the input and 650 to 700°C at the output. The construction materials of the nuclear reactor core in a run are subjected to the effect of large integral fluxes of fast neutrons (to 2 x 10^{23} neutrons/cm^2, E < 0.1 Mev), which leads to changes in volume (swelling), a decrease in the ultimate strength and plasticity, acceleration of creep, and so on. During the process of operation of the nuclear reactor the fuel element jacket can experience three types of loads: stresses corresponding to the external pressure of the heat transfer agent, the pressure of the gas products of fission from the fuel into the compensation volume and the swelling fuel which is in contact with the jacket, the stresses caused by the stationary and nonstationary temperature fields, the stresses caused by the nonuniform swelling of the jacket material under the conditions of a temperature gradient. The results are presented from calculating the stresses occurring in the fuel element jacket of the BOR-60 nuclear reactor as a result of the pressure of the swelling fuel and also the nonuniform swelling of the jacket material under the conditions of a temperature gradient of approximately 45°C with respect to the parameter of the fuel element. The characteristics of the construction materials, the creep under intrareactor conditions, the stress-rupture strength and plasticity are presented. The basic laws of the variation of the creep of the steel under irradiation are illustrated. Illustrations 5; References 16.

USSR

UDC 532.529.5:532.55.001.24

COMPUTATION OF PRESSURE LOSSES DURING THE FLOW OF A TWO-PHASE STREAM IN CHANNELS OF COMPLEX SHAPE

Moscow VOPROSY ATOMNOY NAUKI I TEKHNIKI, SERIYA REAKTOROSTROYENIYE [Questions in Atomic Science and Technology, Series Reactor Construction, Collection of Works] in Russian No 1(12), 1976 pp 46-53

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9G71]

BORISHANSKIY, V. M., ANDREYEVSKIY, A. A., and BYKOV, G. S.

[Text] The authors examine the motion of one-phase and 2-phase streams in channels of complex shape. They obtain dependences for computing pressure losses in bundles of parallel rods and on spacing lattices, which take into account the influence of the relative pitch and character of installing the rods in the shell. The experimental data are presented in the pressure range of 10-160 bar, mass stream velocities of 500-3600 kg/(m^2. sec) and steam contents from 0 to 1. Figures 4; Refrences 15.

USSR

UDC 536.248.2.001.5

INVESTIGATION OF HEAT-EXCHANGE INTENSIFICATION IN ROD ASSEMBLIES WITH LOCAL VORTEXERS

Moscow VOPROSY ATOMNOY NAUKI I TEKHNIKI, SERIYA REAKTOROSTROYENIYE [Questions in Atomic Science and Technology, Series Reactor Construction, Collection of Works] in Russian No 1(12), 1976 pp 15-24

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9G87 by Ye. I. Nevstruyeva]

SMOLIN, V. N., POLYAKOV, R. YE., and YEZHOVA, L. I.

[Text] The results of an investigation on the influence of local vortexers from twisted bands on the limiting power in the center of the rods being heated are given. Crisis was achieved by increasing the elementary power and the thermocouples were fixed by the readings. Tests are conducted at pressures of 74 and 98 bar, mass velocities from 600 to 2000 kg/(m^2·sec) and thermal fluxes from 0.3 to 1.6 MW/m^2 on a 7-rod assembly with a rod diameter of 12 mm and pitch of 14.5 mm, and length of 2 m with 7 vortexers. A 3-rod assembly with rods, 13.5 m in diameter and 7 m in length (model of the RBM-K channel) was equipped with 30 lattice intensifiers installed every 130 mm. Use of local intensifiers installed every 130 mm. Use of local intensifiers leads to a substantial increase in the limiting power

of the channel (by about 1.5 times), increases the critical density of the thermal flux, expands the region of steam contents in the subcritical region, facilitates a more intensive mixing between cells, and may ensure the development of a crisis without substantial increase in wall temperature. Figures 7; References 3.

USSR

UDC 629.113.001.2"401.7"

INCREASING THE LIFE AND RELIABILITY OF THE STEERING-CONTROL BALL JOINTS OF MAZ MOTOR VEHICLES

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 10, 1976 pp 35-36

YAKOVLEV, G. M., SHAMSHUR, A. S., SHUSTERNYAK, M. M., KOKIN, S. G., LUKASHENKO, P. P., and BASHKARDIN, A. G.

[Abstract] In order to increase the reliability and service life of the steering system ball joints in the MAZ family of motor vehicles, complex research was conducted on the hardening of the working surfaces by hot spray coating with wear-resistant materials. Both gas-flame and plasma methods were studied; the TRG-1 oxygen-acetylene apparatus and the UMP-4-64 plasma installation were used in the investigations. The self-fluxing hard alloy PG-KhN80SR4, with melting temperature of 1,050-1,100°C produced a coating microstructure consisting of various chromium carbides and nickel and chromium borides. Tests showed that the PG-KhN80SR4 coatings increased the wear-resistance factor by 1.5 to 3.5 over the 40KhN steel, and by 1.2 to 2.2 over the 12KhN3A steel. Table 1; References 2.

USSR

UDC 693.547.3

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE EFFECT OF ELECTRICAL CURRENT ON THE HARDENING OF CONCRETE

Moscow (Stroizdat) ZIMNEYE BETONIROVANIYE I TEPLOVAYA OBRABOTKA BETONA [Concreting and Heating of Concrete in Winter, Collection of Articles, edited by S. A. Mironov] in Russian 1975 pp 144-155

KRYLOV, B. A., Dr of Technical Science, Professor, KRAVCHENKO, A. F., Engineer, and YARLUSHKINA, S. KH.

[Abstract] The electrophysical phenomena occurring in concrete during the imposition of an electrical field on it were investigated theoretically and experimentally. Theoretical expressions which are derived from colloid chemistry for the amount of possible dehydration Q_e and the rate of liquid movement due to electroosmotic filtration give values on the order of 1-2% for Q_e, while experimental values to 25% have been reported. In order to explain this discrepany the effects of vibration, hydrostatic pressure in a gradient too small to produce significant heating and of temperature drop were isolated and measured. It was found that water loss depended on the water-cement ratio and on concrete type. Vibration was the most important cause of water loss in heavy cement while temperature effects were primary in light, clay-filled cement. Electroosmotic effects ranged from 0 to 2.8%. Under production conditions water loss would be somewhat less, due to mold nonporosity. The low degree of dissociation of cement components and low intensity of the electrical field generated in the electrothermal treatment of concrete are such that hardening is not affected by the current. Petrographic analysis demonstrated that three and 28-day old samples which had undergone small gradient electrical treatment were 10-20% less hydrated than controls. The effect was most marked in samples subjected to constant current and in the preelectrode zone of the sample. Weight loss, however, was less in controls. These phenomena are due to the nonuniform dehydration under electrical treatment. No change in phase composition was noted. Large gradient electrical treatment, in which temperature effects predominate, produced accelerated hydration and crystallization with a disturbance in ettringite crystalline structure. Figures 2; Tables 2; References 13 (Russian).

USSR UDC 693.547.3

AN INVESTIGATION OF CONCRETE DEFORMATION ON FREEZING

Moscow (Stroizdat) ZIMNEYE BETONIROVANIYE I TEPLOVAYA OBRABOTKA BETONA [Concreting and Heating of Concrete in Winter, Collection of Articles, edited by S. A. Mironov] in Russian 1975 pp 87-98

KRYLOV, B. A., Dr of Technical Sciences, Professor, SERGEYEV, K. I., Engineer, and IVANOVA, O. S., Candidate in Technical Science

[Abstract] In order to study the deformative properties of new concrete, samples coated with polyethylene were held at -26 to -30° for 7 days immediately, 1, 2 and 28-days after preparation and compared to ice and to model samples containing ground quartz sand in place of cement also subjected to freezing. Prismatic stability to stress in the frozen state was increased, as was longitudinal deformation, compared to unfrozen concrete, due to the greater fluidity of ice under pressure. The longer the concrete is held before freezing the less its plastic deformation on freezing, indicating that ice resulting from destructive processes is the cause of the increased deformation. Model samples and ice exhibited high plasticity under load. Total longitudinal deformation was decreased by freezing, while creeping deformation under compression was increased in samples frozen directly after or 1 day after preparation. This is due to the influence of the open structure of ice crystals. The model samples had a creeping deformation similar to that of the samples frozen immediately after preparation but 10% less, indicating that both have unstable internal solid-solid bonding, with water and ice separating the particles. After 2 or 28-days of holding before freezing creeping deformation is only slightly elevated. Figures 4; Tables 1; References 5 (Russian).

USSR UDC 693.547.3

THE EFFECT OF EARLY FREEZING ON THE STABILITY AND DEFORMATIVE CHARACTERISTICS OF CONCRETE

Moscow (Stroyizdat) ZIMNEYE BETONIROVANIYE I TEPLOVAYA OBRABOTKA BETONA [Concreting and Heating of Concrete in Winter, Collection of Articles, edited by S. A. MIRONOV] in Russian 1975 pp 79-87

MIRONOV, S. A., Dr of Technical Science, Professor and GLAZYRINA, YE. G., Engineer

[Abstract] The effect of early freezing on the prismatic and cubic stability of concrete and on its initial modulus of elasticity and coefficients of

transverse and volumetric deformation was studied by comparing samples held at -20° for 3 days immediately after preparation to control samples. It was determined that transverse and longitudinal elastic and total deformation was greater in the frozen samples by 11.4-36.2%. This is caused by the increase in concrete volume due to the expansion of frozen water. The experimental concrete also had a modulus of elasticity 10-17% lower than controls. Similar results were not found in concrete frozen after reaching critical (30%) stability. Total longitudinal deformation was decreased by 7-10% in the critical samples while transverse deformation was unchanged. The decreased stability of frozen samples is due to weakened contact between the cement and the heavy filler, so that stress acts primarily on the dissolved portion, whose structure has been disturbed by freezing. Thus the properties of concrete frozen immediately after preparation resemble those of cement. Figures 5; Tables 1; References 6 (Russian).

USSR UDC 532.5:627

IN SITU STUDIES OF THE ACTION OF WIND WAVES ON VERTICAL TUBULAR SUPPORTS

SBORNIK TRUDOV, MOSKOVSKIY INZHENERNO-STROITEL'NYY INSTITUT [Collected Papers. Moscow Construction Engineering Institute] in Russian No 101, 1976 pp 33-39

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B1134 by V. I. Vinogradova]

FILIPPOV, YE. YA., and FURTENKO, V. P.

[Text] Since 1959 the Department of Water Management and Seaports of Moscow Construction Engineering Institute has been doing in situ studies on the Caspian Sea to collect data on the action of wind waves on vertical cylindrical posts. Two posts were installed on the Petroleum Ledges with diameters of 530 and 630 mm. The posts were beams with hinge fastening at the bottom and on the level of the crossbar gantry. The overall length of the measurement posts was 27 m. The research utilized electrical and electro-optical measurement instrumentation with automatic synchronized recording of deformations, point hydrodynamic pressures in six cross sections, wave oscillations and orbital velocities. Analysis of oscillograms showed that waves are irregular in all cases with constantly varying periods and heights. The slope of the largest waves is from 1/15 to 1/22, maximum wave height is 5 m, average periods are 5-9 s. The experimental loads were compared with the calculated values for two analytical spectra of wave oscillations -- the rational fraction spectrum and B. Kh. Glukhovskiy's spectrum; in the first case the theoretical values were considerably higher than the experimental results, and in the second case agreement was good.

USSR UDC 624:539.4

INVESTIGATION OF REAL ACCELERATIONS ARISING IN ELEMENTS OF BUILDINGS DURING EARTHQUAKES BASED ON THEIR CARRYING CAPACITY

Tbilisi SEYSMOSTOYKOST' SOORUZHENII [Seismic Resistance of Buildings, Collection of Works] in Russian, Izd-vo Metsniyereba, No 4, 1975 pp 68-78

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V1132 by Ya. M. Ayzenberg]

MAKHATADZE, L. N.

[Text] The author discusses the procedure and results of evaluating accelerations of the ground during earthquakes on the basis of analyzing damages to structural buildings. The author uses data from investigations of the author on damages to structures during the Dagestan earthquake of 14 May 1970 and the Borzhom earthquake of 3 January 1970. The feature of the suggested procedure is the use of factual data on the strength of materials and structural elements obtained by investigating damaged objects. The author gives a detailed description of the structures of the examined facilities. As a result of the investigations the conclusion is made that the actual accelerations of the ground exceeded by 3-4 times those values which are prescribed by the norms and are used in practical planning. References 19.

USSR UDC 621.699.84

ESTIMATING THE SEISMIC STABILITY OF GAS FIELD STRUCTURES, PIPELINES AND BUILDINGS IN THE GAZLI REGION

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 11, Nov 76 pp 19-20

GEKHMAN, A. S., and SPIRIDONOV, V. V.

[Abstract] Since no instrumental tracings were made of seismic loads on housing and gas field structure in the Gazli region during the earthquakes of 8 Apr, 17 May and 21 Jun 76, visual estimates were made of the damage. Used was the MSK-64 International Scale of Seismic Intensity and a variant of the GOST 6249-52 scale, proposed by the Institute of Construction Mechanics and Seismic Stability, Georgian SSR Academy of Sciences. Damage to buildings and structures during the 17 May tremors is reported: more than 75 percent of the structures suffered damge of the third, fourth and fifth degrees under the MSK-64 scale and damage of the third and fourth degree under the GOST scale variant. Of course, all damage included the after-effects of the

preceding quakes, especially the 8 Apr tremor. Marked slippage of the foundations of compressors and buckling of inflow and outflow pipelines was noted. Additional destruction was wrought by the fire breaking out after the shock.

USSR UDC 539.4

ON THE QUESTION OF THE INFLUENCE OF THE STRESSED STATE ON THE HUMIDITY DEFORMATIONS OF LIGHT CONCRETE

Tbilisi BETONI DA RKINABETONI, BETON I ZHELEZOBETON [Concretes for Rkinabetoni [translation unknown], Concrete and Reinforced Concrete, Collection of Works] in Russian, Izd-vo Metsniyereba, No 7, 1975 pp 31-36

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V1403 by O. M. Popkova]

GABASHVILI, R. YE., KVITSARIDZE, O. I., KEKELIDZE, M. M., and TSILOSANI, Z. N.

[Text] The authors give a brief survey and analysis of the known investigations of the influence of compressive and tensile loads on the deformation of concrete shrinkage. They give the procedure and results of the investigation of the stressed shrinkage of light concrete. They tested prisms 10 x 10 x 40 cm in size prepared from concrete with a volume mass of 1600-1700 kg/m^3 on a lithoid pumice filler. The tests were conducted in 120 day old concrete after its preliminary water saturation for a period of 10-12 days. Part of the samples were subjected to the effect of a compressive load, comprising 0.5-0.7 of the fracturing load. Evaporation of the humidity occurred only through the side surfaces of the samples. No substantial influence was observed in the tests from the stressed state on the amount of humidity evaporated from the concrete, nor, respectively, any significant influence from loading on the shrinkage of light concrete. Analogous results were obtained also during tests of light concrete for water saturation. References 15.

USSR UDC 624.131_539.215

ELASTIC ENERGY OF PILE FOUNDATIONS ACTED ON BY SHORT-TERM LOADS

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of Altay Polytechnic Institute] in Russian No 52, 1975 pp 60-64

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V819 by Yu. V. Mongolov]

VARNAKOV, B. V.

[Text] The author presents the results of instrument observations on the settling of pile foundations of a shop during motion of a bridge crane. Four single-story spans with a network of columns 24 x 12 m and height of the bearing structure of 16.2 m were equipped with cranes having lifting capacity of 50/10 tons. The foundations of the building have piles in the form of individual groups with pile lengths of 12 m with a cross section of 35 x 35 cm. The lower ends of the piles are imbedded into sandy soils of moderate density. The maximum computed load on the pile is 80 tons. The crane loads in the experiment comprised 32% of the total. Observations of the settling of the pile foundation were conducted by placing the crane at a distance of 2-8 m from the group. The results of the observations show that under the action of a short-term (in the limits of 5 min) loads only elastic settlings are developed and the cyclicity of the load does not influence the permament deformations.

USSR UDC 624.131+539.215

LOESS SAGGING SOILS ALONG THE UPPER OB RIVER AND THEIR MECHANICAL CHARACTERISTICS

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 52, 1975 pp 3-11

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V781 by G. A. Lipson]

SHVETSOV, G. I., AREF'YEV, V. S., and SHVETSOVA, N. A.

[Text] The authors carried out a statistical treatment and generalization of the results of determining the mechanical characteristics of loess sagging soils along the upper Ob River. For computation of the compression modulus they experimentally established the sizes of the side pressure. Using the methods of mathematical statistics they investigated the dependence of the

modulus of strain and the parameters of linearity of the loess soils on the coefficient of porosity by allowing for the values of the degree of humidity. The size of the correlation factor for the moduli of strain was 0.95-0.99, and for adhesion and the angles of internal friction, respectively, 0.85-0.98. They compiled a table of normative and computed characteristics of loess rocks of the upper Ob River. References 8.

USSR UDC 624.131+539.215

DEPENDENCE OF THE MODULUS OF SAGGING AND RESISTANCE OF LOESS ROCKS TO SHIFT ON THE INITIAL HUMIDITY

Tashkent TRUDY TASHKENTSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of Tashkent Polytechnic Institute] in Russian No 138, 1975 pp 135-136

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V777 by Yu. P. Lyapichev]

ISMAILOV, I.

[Text] When soils from the lower level with a humidity of 10-15% (with retention of porosity) are used as bases of buildings, the size of the modulus of sagging is sharply reduced due to the increase in the modulus of settling. The results of the investigations on establishing the order of magnitude of reduction in the indices of resistance of loess rocks to shift as a function of the initial humidity confirm the results of tests on determining the modulus of sagging. When the humidity is increased above 20% a sharp reduction is observed in the angle of internal friction φ_n all the way to 5°-6° and below with the corresponding reduction in the overall adhesion to $C_w = 0.05$ kg/cm^2. With increase in the depth of the bed of loess rock the values of the modulus of sagging are reduced and for these levels no sharp reduction is observed in the value of the angle of internal friction ($\varphi_n = 20°$) and overall adhesion ($C_n = 0.20$ kg/cm^2) even upon increase in the humidity above the yield stress. Analysis of the data of laboratory tests of loesses of different composition and state under different loads demonstrates a decrease in the modulus of sagging and an increase in the threshold of sagging of loess soils in the depth of the strata due to the properties of the rock itself (resistance to shift S_{pw}), and also due to the decrease in adherance at a certain level of the compressive stress from the weight of the building and the natural load under conditions of natural equilibrium. The established positions are essential for decreasing the loosening strain under conditions of increased depth of the foundation.

USSR UDC 536.248.2.001.24

GENERALIZED DEPENDENCE FOR CRITICAL THERMAL FLUXES DURING THE BOILING OF LIQUIDS UNDER CONDITIONS OF FREE MOTION

TEPLOFIZIKA I TEPLOTEKHNIKA. RESPUBLANSKIY MEZHVEDOMSTVENNIY SBORNIK [Heat Physics and Heat Engineering. Republic Interdepartmental Collection] in Russian No 30, 1976 pp 3-9

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract Na 9G94 by V. I. Kashinskiy]

TOLUBINSKIY, V. I., KICHIGIN, A. M., and PVSTEN', S. G.

[Text] The authors suggest a generalized dependence for determining the critical thermal flux during the boiling of liquids under conditions of free motion, obtained from the general equation of similarity of the process of bubbling. It was shown that the data on q_{cr}, obtained during the boiling of water, a standard, methanol, benzine, propane, pentane, carbon tetrachloride, freons, oxygen, nitrogen, helium and hydrogen, are grouped around a straight line (with an accuracy of $\pm 35\%$), which is described by an equation in dimensionless form: $K_{cr}\sqrt{\frac{e''}{e'}} = 7\,\overline{Fo}^{0.5}$. The authors give the computational formula for q_{cr} corresponding to the formula: $q_{cr} = 7r\sqrt{af\rho'\rho''}$, where q_{cr} is the critical density of the thermal flux in W/m^2; r is the heat of steam formation in J/kg; a is the coefficient of thermal conductivity in m^2/sec; f is the frequency of formation and bursting of steam bubbles per second; ρ' and ρ'' are the density of the liquid and steam in kg/m^3. It is noted that for water, organic and cryogenic liquids in determining f, one can use the presented dependences $f = \varphi(P_{cr}/P)$ in a broad range of pressures. The authors also obtained a satisfactory agreement of computed quantities for q_{cr} with the experimental data during the development of boiling of liquid potassium and sodium. Figures 3; Table 1; References 26.

USSR UDC 536.248.2.001.5

NEW EXPERIMENTAL DATA ON HEAT YIELD DURING THE BOILING OF WATER

SBORNIK TRUDOV. NAUCHNO-ISSLECOVATEL'SKIY ENERGICHNIY INSTITUT IMENI G. M. KRZHIZHANOVSKOGO [Collection of Works. Scientific Research Energy Institute imeni G. M. Krzhizhanovskiy] in Russian No 46, 1975 pp 20-27

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9G91 by V. I. Kashinskiy]

YUSUFOVA, V. D., UGREKHELIDZE, G. P., and BRONSHTEYN, A. I.

[Text] Data are given on heat yield during the boiling of water inside a vertical tube, 4 mm in diameter, and a heated length of 455 mm under

conditions of forced lifting motion at a mass velocity of 1500 kg/(m^2·sec), pressures of 4.9, 9.8, 29.4, 58.8, 98.1, 147 and 196 bar, underheating of the water at the input from 0 to 5°C and with change in the heat load from 0.1 to 2.0 MW/m^2. The authors obtained the dependence of the temperature pressure between wall and liquid on density of the thermal flux. They demonstrate the satisfactory convergence of the coefficients of heat exchange obtained in the experiments with those computed from the formulas of various authors. Figures 3; Tables 2; References 10.

USSR UDC 536.2.022.001.5

INVESTIGATION OF HEAT CONDUCTIVITY OF ORDINARY WATER AT HIGH PRESSURES

IZVESTIYA SEVERNO-KAVKAZKOGO NAUCHNOGO TSENTRA VYSSHEY SHKOLY. SERIYA TEKHNICHESKIYE NAUKI [Bulletin of North Caucasus Scientific Center of the Higher School. Series Technical Sciences] in Russian No 1, 1976 pp 100-101

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9G75]

RASTORGUYEV, YU. L., GIGOR'YEV, B. A., and ISHKHANOV, A. M.

[Text] The results of an investigation of the thermal conductivity coefficient of water (in the temperature range of 14.8-210.2°C and pressures up to 2000 bar), carried out by the method of coaxial cylinders. The maximum measurement error did not exceed ±1.5%. An examination is made of the question on the character of the temperature field of the measuring cell with end faces operating by the method of a flat layer. A study is made of the thermal conductivity of water near the saturation line and the region of the maxima of thermal conductivity. A discussion is given of the shift in the maximum upon increasing the pressure to the region of higher temperature. References 8. [Grozen' Petroleum Institute].

USSR UDC 662.75:543.87

STUDY OF THE INFLUENCE OF HEATING CONDITIONS OF REACTIVE FUELS ON THE KINETICS OF OXYGEN CONSUMPTION

EKSPLUAT. SVOYSTVA TOPLIV, SMAZOCH. MATERIALOV I TEKHN. ZHIDKOSTEY, PRIMENYAYEMYKH V GRAZHD. AVIATSII. in Russian Kiev No 1, 1975 pp 64-65

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 10, 1976 Abstract No 10.34.19 from the resume]

MALYSHEV, V. V., ASTAF'YEV, V. A., and BORISOV, V. D.

[Text] A study is made of the process of consumption of oxygen by reaction fuels with various degrees of purity as they are heated in the TSRT-2 device, as well as the influence of temperature, phase ratio, and presence of a copper plate on this process. Replacement of oxygen by nitrogen in the reaction cavity of the instrument proportionally decreases the quantity of oxidation products formed. This indicates the effectiveness of the method of deoxidation of fuels to increase their high temperature stability. Figures 2.

USSR UDC 536.24:536.42;669-154

STUDY OF HEAT EXCHANGE IN AXISYMMETRICAL DIFFUSORS IN THE DISPERSED MODE OF FILM BOILING

[TR.] MOSK. AVIATS. IN-TA in Russian 1976 No 351, pp 82-88

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12B490 by Yu. Ye. Pokhvalov]

KALININ, E. K., KOCHELAYEV, YU. S., and FIRSOV, V. P.

[Text] An experimental study is performed of heat transfer in the mode of film boiling of nitrogen in diffusors with aperture angles of 5°40', 14° and 20° and length 0.16 m. The diffusors were made of stainless steel with a wall thickness of 0.5 mm. The pressure in the experiments varied from 1.02 to 12.2 bar, nitrogen flow rate from 0.008 to 0.05 kg/s, thermal load from 3 to 26 kw/m^2, mass vapor content at inlet from 0.34 to 1. The stream was photographed. The specific heat flux and temperature of the internal surface of the diffusor wall were determined by solving the reverse problem of heat conductivity. The parameters of the two-phase stream were determined by solving a system of one-dimensional differential equations describing a model of the dispersed film boiling mode suggested by one of the authors earlier. Calculations were performed on a BESM-4 computer.

Unevenness is discovered in the distribution of drops through the cross section of the diffusor: near the wall -- heated vapor, most of the drops moving in the center of the stream. As the vapor content decreases, the concentration of drops over the cross section becomes more even. It is concluded that under the conditions studied, the main mechanism of heat transfer is convective heat exchange of vapor with the wall. The liquid drops intensify the heat transfer by evaporation and influencing the turbulence of the layer along the wall. Over the length of the diffusor, heat transfer decreases in comparison to heat transfer in a straight channel, which is explained by the increase in thickness of the superheated vapor layer at the wall under the influence of the positive pressure gradient and the decrease in the intensifying role of the droplets. This effect is more significant, the greater the aperture angle of the diffusor. The influence of pressure and the temperature factor on heat transfer is not detected, while the influence of vapor content is similar to that in straight channels. As the Reynolds number increases, there is an increase in the intensifying role of the droplets. The results of the experiments are summarized by a dimensionless formula with an accuracy of $\pm$25%.

USSR UDC 536.24

ANALYSIS OF BUNDLES OF PIPES TRANSVERSELY STREAMLINED BY A STREAM OF WATER IN THE PROCESS OF HEAT EXCHANGE AT CRITICAL Re NUMBERS

TRUDY AN LITSSR [Works of the Academy of Sciences Lithuanian SSR] in Russian, Series B, No 5(90), 1975 pp 93-100

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B529 by A. S. Mazo]

ZHUKAUSKAS, A. A., and ULINSKAS, R. V.

[Text] For bundles of pipes with corridor and checkerboard arrangement 1.25 x 1.25 and 1.5 x 1.5 (pitch refers to the diameter of the pipe), streamlined by a transverse stream of water with a Reynolds number of $Re = 5 \times 10^4 - 2 \times 10^6$ (determined from the maximum velocity, diameter of the pipe and viscosity at the current temperature) and a Prandtl number of Pr = 3-7, on the basis of the experimentally found (around the perimeter of the pipe) coefficient of heat yield, the authors established the length of the zone of transition in the boundary layer, the place of collision of the stream with the pipe at the corridor points, the position of the maximum of the coefficient of heat yield in the checkerboard points as a function of the Re number. They determine the zones of separation flow and the parameters of the vortex paths. For bundles with a pitch of 1.25 for Re values less than 2×10^5, the transition begins at $\varphi = 105°$; with increase

in Re the point of the beginning of transition is shifted upward along the stream to $\varphi = 24°$ with Re = 1.8 x 10^6. With a larger pitch (1.5) the transition in the entire Re range begins earlier. At the checkerboard points with subcritical Re values the zone of transition has a larger expanse, with growth in Re it is decreased and when Re = 5 x 10^5 becomes identical for both bundles. The position of the point of collision in the corridor point depends on the Re and is stabilized with increase in Re at $\varphi = 60°$ and 50° respectively for pitches of 1.25 and 1.5. The position of the maximum of the coefficient of heat yield for the checkerboard bundles is shifted from the rear critical point at subcritical Re values to the region of maximum velocities. Separation of the current is observed at $\varphi = 160°$ (pitch of 1.25) and $\varphi = 150°$ (pitch of 1.5) for bundles with checkerboard arrangement and for $\varphi = 150°$ (pitch of 1.25) and $\varphi = 130°$ (pitch of 1.5) for bundles with corridor arrangement. References 10.

USSR UDC 536.244.001.5

CONDUCTIVE HEAT EXCHANGE OF A PIPE BUNDLE FOR ASYMMETRIC FLUSHING

Minsk V. SB. TEPLOMASSOOBMEN-V. T. 1, CH. 2 [Collection of Works: Heat and Mass Exchange--No 5, Vol 1, part 2] in Russian 1976 pp 26-30

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11G95]

MIKK, I. R., VESKI, A. YU., and KRUUS, R. A.

[Text] The results of the experimental investigation of convective heat exchange during flow of air around a corridor bundle of pipes are presented. A study is made of the effect of the 1) angle beta between the direction of the flow through the bundle and the axes of the pipes; 2) the angle gamma between the direction of flow and the density of the series of pipes. The Re number varied from $5 \cdot 10^3$ to $2.5 \cdot 10^4$; the stepsize of the series s_2/d was from 1 to 1.7. The investigation of the effect of beta was performed on a model made of one series of pipes with a diameter d = 14 or 30 mm. For beta = 0, 32 and 90° data are presented on the effect of s_2/d on the convective heat exchange. The study of the effect of gamma was performed on a model with a number of pipe series from 5 to 12. For gamma = 32.5° (Re = $2 \cdot 10^3$) $4 \cdot 10^3$, $8.5 \cdot 10^3$ and gamma = 50° (Re = $2 \cdot 10^3$, $8.5 \cdot 10^3$) data are presented on the Nu number for variation of s_2/d from 1 to 1.3. Data are also presented on the effect of the variation of gamma from 0 to 45° and the order number of the series in which the pipe is located, on the number Nu and the data with respect to dependence of the mean number Nu for the 12-bundle on gamma (Re = $2 \cdot 10^3$ and $6.3 \cdot 10^3$). There are 3 illustrations. [Tallin Polytechnical Institute].

USSR UDC 536.248.2.001.5

INVESTIGATION OF HEAT EXCHANGE IN AXISYMMETRIC DIFFUSERS IN THE DISPERSED MODE OF FILM BOILING

[TRUDY] MOSKOVSKOGO AVIATSIONNOGO INSTITUTA [(Transactions) of Moscow Aviation Institute] in Russian No 351, 1976 pp 82-88

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 12, 1976 Abstract No 12G74 by G. B. Rybchinskaya]

KALININ, E. K., KOCHELAYEV, YU. S., and FIRSOV, V. P.

[Text] Heat exchange is experimentally studied in axisymmetric diffusers with aperture angles of 5°40', 14° and 20° and length of 0.16 m in steady-state dispersed film boiling of nitrogen with rising flow motion. Range of pressure variation 1-12 kgf/cm^2, flowrate 0.008-0.05 kg/s, heat flux 3-26 kW/m^2, mass vapor content at the inlet 0.34-1. A visual section was used for studying the structure of the dispersed flow. The parameters of the two-phase flow were numerically determined on a computer by solving a system of homogeneous equations describing the model of dispersed film boiling proposed by one of the authors. Experimental data were used for closure of the system. The results of experiments are given in the form of curves for the Nusselt number in the diffuser as a function of pressure, the Reynolds number of the vapor, the vapor content at the inlet to the diffuser and the aperture angle of the diffuser. A relation is given that generalizes the experimental data with a spread of $\pm$25%. Figures 4; References 4.

USSR UDC 536.24:536.42:669-154

TEMPERATURE CONDITIONS OF PIPES IN BOILING OF WATER AND AQUEOUS SOLUTIONS

Novosibirsk NEKOTORYYE ZADACHI GIDRODINAMIKI I TEPLOOBMENA [Some Problems of Hydrodynamics and Heat Exchange, Collection of Papers] in Russian 1976 pp 122-127

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B511 by S. G. Povsten']

KASHINSKIY, V. I.

[Text] The temperature of a heat-transfer surface was determined by two methods: by thermocouples, and indirectly by a salt method. The studies were done with forced motion of distillate and aqueous solutions of calcium

sulfate in an electrically heated pipe of 00Kh16N15MZB steel 6.4 mm in diameter and 28 mm long under a thermal load of 1 MW/m^2 at a mass flowrate of 900 kg/m^2s and pressures of 1-7 absolute atmospheres. A flow diagram is plotted that characterizes the mode of developed boiling over the entire length of the pipe as the pressure varies. Temperature data agree satisfactorily with the Rosenau equation with constant $\alpha = 0.0078$. It is found that the onset of boiling arises primarily at the outlet from the heated channel with slight overheating of the walls (no more than 2°C). Relations are given for [boiling conditions] as a function of saturation temperature (pressure), the temperature of the steam-forming surface for a clean pipe in the case of developed boiling of the distillate, and the temperature on the interface between steel and calcium sulfate deposit. Time changes in the relative concentration and the temperature differential in the layer of deposits are determined. It is shown that dense deposits cause only additional thermal resistance, while loose porous deposits may result in abrupt surges of temperature in the wall in boiling of aqueous solutions and distillate.

USSR

UDC 532.72;669.015.23

HEAT EXCHANGE OF A FLOW OF GAS SUSPENSION UNDER CONDITIONS OF INERTIAL FALL-OUT OF PARTICLES TO THE WALL OF THE CHANNEL

Minsk TEPLOMASSOOBMEN - V. MATERIALY PYATOY VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials of the Fifth All-Union Conference on Heat and Mass Exchange] in Russian Vol 6, 1976 pp 243-247

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B613 by R. Sh. Vaynberg]

SHCHUKIN, V. K., FILIN, V. A., MIRONOV, A. I., IDIATULLIN, N. S., KOVAL'NOGOV, N. N., YAKSHIN, A. A., NADYROV, N. A., and FAKHRUTDINOV, I. KH.

[Text] An experimental study was done on local heat exchange of a flow of gas suspension of solid particles of various concentrations with the walls of the subcritical part of a nozzle and a short curved channel with cooling of the flow over a range of nozzle parameters of: pressure 2.8-3.7 bars, flow temperature 530-570 K, Reynolds number $(1\text{-}1.1)\cdot10^5$, the respective channel parameters being 1 bar, 440-520 K and $Re = (0.56\text{-}2.35)\cdot10^5$. The solid phase was aluminum oxide powder with particle sizes from 1 to 32 μm. It is noted that heat transfer is intensified with increasing concentration of solid phase, particularly in the region of inertial fall-out of particles; for a nozzle the relative increase in the heat-exchange coefficient compared with a single-component gas flow under identical hydrodynamic and thermodynamic conditions is $\sim$1.9, while the corresponding increase is $\sim$6 for a curved

channel of quadrilateral cross section. Analysis of numerical calculations and experimental data shows that intensification of heat exchange is a consequence of the influence of solid particles on the structure and thermal resistance of the flow in the wall zone.

USSR UDC 536.248.2.001.5

EXPERIMENTAL INVESTIGATION OF THE HEAT EXCHANGE AND PRESSURE LOSSES FOR THE BOILING OF SODIUM IN A VERTICAL TUBE

Minsk V. SB. TEPLOMASSOOBMEN-V. MATERIALY V VSES. KONF. PO TEPLOMASSOOBMENU, T. 3, CH. 1 [Collection of Works: Heat and Mass Exchange--V. Materials of the Fifth All-Union Conference on Heat and Mass Exchange, Vol 3, Part 1] in Russian 1976 pp 147-156

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11G110 by V. K. Shikov]

ZEYGARNIK, YU. A., and LITVINOV, V. D.

[Text] Data are presented on the initial superheatings and the superheatings at the boiling point. A study was performed for heat flux densities of 0.2 to 1.1 megawatts/cm^2, mass velocities of 150 to 400kg/(m^2sec), mass vapor content to 0.45, a pressure of 0.1 to 0.2 MPa. The results are presented from comparisons of the data on the pressure losses with the calculated procedures of different authors. The best agreement occurred with the Stone calculation function ($\pm$20 percent). On the basis of the data on heat transfer the conclusion is drawn of the presence in the experiments of the annular flow regime for evaporation from the film surface (bubble boiling on the wall is absent). This conclusion is used when comparing the experimental data with the data of the above authors. There are seven illustrations and 16 references. [IVT Institute of the USSR Academy of Sciences, Moscow]

USSR UDC 536.242:532.517.4.001.5

EFFICIENCY OF THE HEAT TRANSFER ACROSS THE BUNDLES OF PIPES AROUND WHICH FLOW IS TAKING PLACE IN THE RANGE OF CRITICAL REYNOLDS NUMBERS

Minsk V. SB. TEPLOMASSOOBMEN, V. T. 1, CH. 2 [Collection of Works: Heat and Mass Exchange--No 5, Vol 1, Part 2] in Russian 1976 pp 13-21

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11G97 by I. G. Zal'tsman]

ZHUKAUSKAS, A. A., and ULINSKAS, R. V.

[Text] The results of the experimental investigation of the mean heat transfer and hydraulic drag for critical flow of water around the corridor and checkerboard bundles are presented for the Re numbers in the range from $4 \cdot 10^4$ to $2 \cdot 10^6$ corresponding to the subcritical and supercritical streamlining flow (the pipe diameter which determines the speed--the speed in the least through cross section of the bundle--was taken as the defining dimension). The experiments were performed for water temperatures of 20 and 50°C. The calorimetric pipe 30 mm in diameter made of stainless steel with wall thickness of 0.25 mm corresponded to the case of the constant heat flux on the wall. The generalized criterial relations are presented for the Nu and Eu numbers. The significant increase in the heat transfer on going to the critical streamline flow took place for Re = $2 \cdot 10^5$ to $5 \cdot 10^5$. The efficiencies of the investigated bundles were calculated and analyzed. There are three illustrations, 11 references. [Institute of Physicotechnical Problems of Power Engineering of the Academy of Sciences of the Lithuanian SSR].

USSR UDC 662.951.2

PROCESSES OF COMBUSTION IN FLAMELESS BURNERS

Saratov RASPREDELENIYE I SZHIGANIYE GAZA [Gas Distribution and Combustion, Collection of Works] in Russian No 1, 1975 pp 3-21

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9T56 by E. I. Rozenfel'd]

LEVIN, A. M.

[Text] The atuhor analyzes the aerodynamic and heat engineering features of the operation of tunnel burners (TB) of total preliminary mixing and burners of infrared radiation (IRB). The author notes that for the TB there exists an optimal amount of intensity of turbulent mass exchange between zones of

recirculation and transit jets, for which the maximum rate of combustion reaction is reached. Minimum underheating in the TB exists with a value of the coefficient of air excess α = 1.05-1.15. Equalization of the temperature and concentration fields in the tunnel is reached by the end of the initial segment of the jet of the gas-air mixture ($6d_0$); total depletion is reached on the segment with a length of L = $12d_0$. IRB were investigated: with a porous diaphragm, with perforated ceramic, and with two metal grids. The maximum temperature of the surface of the fire nozzle and the most complete burning are achieved in the IRB with perforated ceramic at α = 1.05. A temperature near that of the fire surface is retained in the fire channels only at a depth of 1 mm, and then is lowered sharply. With a constant specific heat load the temperature of the fire surface grows with increase in the diameter of the fire openings. Figures 11; References 11.

USSR

UDC 662.613:621.18

INVESTIGATION OF THE PROCESSES OF FORMING HARMFUL GASEOUS EMISSIONS FROM THE STEAM GENERATORS OF A THERMOELECTRIC POWER PLANT

Leningrad MASHINY I OBORUDOVANIYE TSELLYULOZNO-BUMAZHNYKH PROIZVODSTV (MEZHVUZNIY SBORNIK NAUCHNYKH TRUDOV LENINGRADSKOGO TEKHNOLOGICHESKOGO INSTITUTA TSELLYULOZNO-BUMAZHNOY PROMYSHLENNOSTI) [Machinery and Equipment for Cellulose-Paper Production (Inter-VUZ Collection of Scientific Works of the Leningrad Technology Institute of the Cellulose-Paper Industry), Collection of Works] in Russian 1975 pp 201-205

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 8T109 by E. I. Rozenfel'd]

MISHIN, O. N.

[Text] The author investigated the process of forming harmful matter in the combustion products during the burning of sulfurous black oil M-100 in a BKZ-100 boiler, equipped with five nozzles having a power of 1500-1800 kg/hour each. With a coefficient of air excess of α = 1.22 and steam productivity of the assembly of 50, 60 and 75 T/hour the temperature in the combustion zone was equal respectively to 1420, 1500 and 1580°C; the concentration of sulfur anhydride behind the water economizer was respectively 0.9, 0.92, 1.43 and 1.57 g/m^3, and the concentration of nitric oxides was 0.72, 0.74, 1.03 and 1.28 g/m^3. The insignificant change in concentration of nitric oxides with a decrease in α from 1.1 to 1.02 is due to the opposite effect of two factors: increase in temperature and reduction in O_2 concentration in the combustion zone. The author notes a substantial difference between the experimental amounts of nitric oxide concentrations and computed amounts obtained from the formula NO = $2 A \cdot D_e^{0.8} \cdot q_v^{0.5} \cdot \alpha_f^3$. [De is the equivalent diameter of the furnace

in meters, q_v is the volume density of the thermal flux in MJ/(m^3·hours), α_f is the coefficient of air excess in the furnace, A = 0.17 is the coefficient of proportionality]. Tables 2; References 5.

USSR UDC 621.181.8.004.68.001.4

HYDRAULIC OPERATION OF THE STEAM SUPERHEATER OF A PK-41-1 BOILER WITH SHUNTED BYPASS OF THE STEAM

TRUDY VSESOSUZNOGO TEPLOTEKHNICHESKOGO NII. URAL'SKIY FILIAL [Works of the All-Union Heat Engineering Scientific Research Institute. Urals Branch] in Russian No 12, 1976 pp 58-62

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9R70]

BARANENKO, V. D., and CHEBULAYEV, V. V.

[Text] The authors give the results of tests on a PK-41-1 boiler of 300 MW sets with the installation of a shunted pipeline on the output collector of the primary convective intermediate superheater as a means of struggling with hydraulic evolvement, arising due to collector nonuniformity. The computed and experimental data on changes in pressure drops are presented graphically. Hydraulic evolvement of the intermediate superheater with shunted bypass was found to be equal to 0.85 (without it, it was equal to 0.66). Reconstruction of the output stage of the intermediate superheater raised the reliability of it due to the more uniform distribution of the steam over the coils and decreased the overall resistance of the stage due to the flow of part of the steam along the shunted pipeline. Figures 2; References 1.

USSR UDC 621.181.7.001.24.004.2"313"(47+57)

PREDICTION OF THE POSSIBILITY OF BOILER OPERATION WITH LIQUID SLAG REMOVAL BASED ON THE CHEMICAL COMPOSITION OF THE ASH (KUZBASS)

TRUDY VSESOSUZNOGO TEPLOTEKHNICHESKOGO NII. URAL'SKIY FILIAL [Works of the All-Union Heat Engineering Scientific Research Institute. Urals Branch] in Russian No 12, 1976 pp 249-253

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9R26 by R. L. Eygenson]

NOVITSKIY, N. V., MARTYNOVA, M. I., and KARAGODINA, N. V.

[Text] The authors describe a new procedure for predicting the operation of boilers with liquid slag removal upon burning of Kuznetsk coals based

on the chemical composition of the ash. They obtained equations of the condition of reliable operation of the furnaces with liquid slag removal: $t_t \geq t_{es}+70°C$ and $t_t \geq 1155+314\ k_v$, where t_t is the temperature of the gases in the tap in °C; t_{es} is the temperature of exit of the slag in °C; k_v is the coefficient of viscosity of the ash. The authors give the results of comparing the experimental and computed temperatures of the normal liquid slag removal; these results show a good convergence of these temperatures. With a known chemical composition the obtained formulas may be used for operative monitoring of the viscosity characteristics of the ash, slag and disposal. Figure 1; Table 1; References 6.

USSR UDC 621.313.522

INVESTIGATION OF A DETONATION COMBUSTION CHAMBER AND INFLUENCE OF MHD-INTERACTION OF DETONATION RATE

SBORNIK TRUDOV. NAUCHNO-ISSLEDOVATEL'SKIY ENERGETICHESKIY INSTITUT IMENI G. M. KRZHIZHANOVSKOGO [Collected Papers. Scientific Research Institute of Power Engineering imeni G. M. Krzhizhanovskiy]

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.152]

ZHIMERIN, D. G., MIRONOV, E. A., POPOV, V. A., and SINKEVICH, O. A.

[Text] Results are given from a feasibility study of utilizing detonation fuel combustion. It is suggested that detonation may be very useful in specific areas of modern technology. As an example of such an application of the detonation process the authors consider direct conversion of thermal energy to electrical energy. As regards the MHD method of energy conversion, using an acceleration nozzle should provide a sharp increase in the efficiency of converting heat to work, although the nozzle would not operate in the rated conditions in this case. The detonating capacity of methane-air mixtures as a possible working fluid can be increased by using promoting additives. At the present time a detonation chamber is capable of stable operation on both gaseous and liquid fuel. It can be assumed that when certain technical difficulties have been overcome it will be possible to operate a detonation chamber on atomized solid fuel as well. Perfection of the detonation combustion chamber will obviously increase its technical capabilities and make it useful for other areas of application. Figures 8; References 16.

USSR UDC 536.46:533.6+534.222.2

ON THE DETERMINATION OF THE LIMIT OF PROPAGATION OF A FLAME

Tomsk 1-YA VSESOYUZNYY SHKOLA-SEMINAR PO TEORII GORENIYA [First All-Union School-Seminar on the Theory of Combustion, Collection of Works] in Russian, Tomsk University Press, 1975 pp 64-67

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B628 by Yu. S. Ryazantsev]

BUNEV, V. A., BABUSHOK, V. I., and BABKIN, V. S.

[Text] The authors mention the lack of a strict justification both of the principles of developing standard methods of determining the limits of propagation of a flame and of the corresponding recommendations of industry on questions of explosion safety. They briefly report on the experimental investigation of the influence of the time the mixture remains in the reactor before combustion on the size of the limit. The tests were conducted with air mixtures of hydrogen and a series of hydrocarbon fuels. Depending on the time the mixture remains in the vessel the authors determined in parallel the limits of propagation of a flame and the rate of change in the amount of oxygen. The test results showed that the limit is a function not only of composition and state of the original mixture but also the time the mixture remains in the heated vessel. For example, at a pressure of 1.2 technical atmospheres and at temperatures greater than 240°, the enriched limit for mixtures of hydrogen and air is decreased by linear law with growth in residence time. Here one observes a linear decrease in concentration of oxygen in time, and the rate of drop in oxygen grows with temperature. Treatment of the surface of the reactor exerts an influence both on the rate of drop in oxygen and on the rate of change of the enriched limit. It was shown that the limit at high temperatures depends on the time of residence, which is associated with change in composition of the mixture in time, and possibly with a slight change in pressure and temperature as well as treatment of the surface.

USSR UDC 536.46.533.6+534.222.2

ON THE ROLE OF CHEMICAL PROCESSES DURING IGNITION AND COMBUSTION OF A JET OF HYDROGEN IN AIR

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 76-79

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B637 by V. I. Yagodkin]

GOLOVICHEV, V. I., TARAN, M. D., and YASAKOV, V. A.

[Text] A numerical computation was made of the ignition of a jet of hydrogen in the atmosphere using the equations of a boundary layer and detailed

reporting of the reactions of oxidation. It was shown that the frequently used scheme of nine reactions must be supplemented and raised to 20 in the temperature region less than 1000°K, which leads to an increase in the ignition holding time. The authors mention the appearance of a spatial separation of the intermediate products of the reaction. They make a conclusion about the strong influence of mixtures of ozone and hydrogen and ozone and air. References 7.

USSR UDC 532.517.4:532.529.5.001.5

STUDY OF THE PROPAGATION OF SINGLE AND DOUBLE COMPONENT TWISTED JETS OF VARIABLE DENSITY

Tallin V. SB. TURBULENT. DVUKHFAZ. TECHENIYA [Collection of Works: Turbulent Two-Phase Flows] in Russian 1976 pp 69-87

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11G56]

KRASHENINNIKOV, S. YU.

[Text] The laws describing the distribution of the averaged flow parameters and the single and double component twisted jet streams propagated in free space and in a cylindrical chamber are defined. In the experiments the escape rate was 5 to 50 m/sec; the diameter of the jet channels is 8 to 18 mm, the chamber diameter is 20 to 70 mm. The distributions of the average velocity with respect to time and the impurity concentration were determined. The ratios of the velocities and the densities of the mixed gases varied within the range of 0 to 10 and 0.25 to 7, respectively. The data on the structure of the flow, the laws of equalization of the velocity and concentration distributions on variation of the intensity of the twisting in the 0 to 2.5 range were obtained. The generalization of the results of measuring the concentration distributions in the flow regions next to the axis and next to the wall was carried out. There are 6 illustrations and 8 references.

USSR UDC 662.75:662.61

COMBUSTION OF LIQUID FUEL IN A FLUIDIZED BED OF INERT MATERIAL

TRUDY URAL'SKOGO POLITEKHNICHESKOGO INSTITUTA [Transactions of Ural Polytechnical Institute] in Russian, Collection 242, 1976 pp 58-64

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 12, 1976 Abstract No 12T73 by M. B. Ravich]

ANDRYUSHCHENKO, YU. S.

[Text] Solar oil and grade 60 fuel oil were burned in a fluidized bed of different fractions of refractory clay in a heat-insulated reaction vessel

138 mm in diameter and 1 m high. The lower part of the vessel contained a perforated grating with holes 1.2 mm in diameter and a live section of 3%. The fuel was sprayed in with pneumatic injectors with capacity of 1.1-1.8 kg/hr. The flowrate of the atomizing air was 10-15% of the total air flow. The viscosity of the fuel oil heated to 85°C was 9°VU [0.666 St.]. Pressure of the atomizing air was up to 2 kgf/cm^2. Air temperature was 120°C. The empty reaction vessel was heated to 700-800°C with a high excess air ratio. The vessel was then charged with the refractory clay and the excess air ratio was reduced to the predetermined level. At 300-400°C 80% of the fuel oil boils away, and all of the solar oil. When the clay particle diameter is 1.4 mm, the products of combustion of grade 60 fuel oil at a height of 700 mm have the following composition: CO_2--11%, CO--2%, and O_2--5%. Figures 4; References 5.

USSR UDC 536.70

EXERGETIC BALANCE OF A GAS-AND-SOLID-PARTICLE SUSPENSION

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 5, 1976 pp 169-173 manuscript received 19 May 75

YASNIKOV, G. P., and BELOUSOV, V. S., Sverdlovsk

[Abstract] The purpose of this paper is to derive a local exergetic balance equation for a flow of a mixture of gas and solid particles and to analyze on its basis the factors which determine the magnitude of exergetic losses. The exergetic method of thermodynamic analysis makes it possible to estimate losses of efficiency and the degree of ideality of processes in different components of thermal power units and to point out ways of improving them. Integral balance equations form the basis of the exergetic method. Reasons for loss of efficiency are not always possible to delineate, especially in systems in which exist a large number of thermodyanic forces and irreversible flows caused by them and interacting with one another. The behavior of these systems is usually described by methods of the thermodynamics of irreversible processes, whose basis is the entropy balance equation. The entropy effect depends on the velocity of irreversible processes and the corresponding thermodynamic forces. It is used as a measure of energy dissipation in the system and can be used to determine exergetic losses. This approach makes it possible to express losses as a function of velocities and thermodynamic forces characterizing each of the irreversible processes taking place in the system. The relationship between thermodynamic forces and parameter gradients makes it possible to reveal the influence of the structure of the fields of these gradients on the magnitude of exergetic losses. This in turn makes it possible to use variational methods and to formulate problems for optimizing and controling losses. A mixture of a gas and particles of solid material is described

by a model of a two-velocity, two-temperature medium. Exergetic losses in this two-phase system caused by irreversibility of processes are associated with the thermal conduction and viscosity of the phases, interphase heat exchange, and friction between pulses. A formula is derived for exergetic losses in the absence of phase velocity and temperature gradients. As an example of applying the local exergetic balance equation, a calculation is made of losses due to the irreversibility of interphase heat exchange in the boundary layer of the particle. The local exergetic balance equation can be used to analyze processes in various thermal power units making use of dust-and-gas streams, to find exergetic losses in various irreversible processes, and to single out losses according to their causes. References 15: 15 Russian.

USSR UDC 629.113:621.43

INVESTIGATION OF THE FLAMMABILITY OF GASOLINES AND THEIR INDIVIDUAL FRACTIONS IN DIESELS

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 11, Nov 76 pp 7-10

BOLDYREV, I. V., candidate of technical sciences, and DYATLOV, YE. G.

[Russian abstract provided by the source]

[Text] The feasibility of using existing criteria of fuel flammability to evaluate the flammability of gasolines in a diesel is analyzed on the basis of laboratory and engine studies, including tests on the IT9-3 installation. It is shown that the octane numbers of gasolines do not completely characterize their flammability under diesel conditions. Approximate criteria convenient for practical use are proposed that enable one to evaluate the flammability of different fuels and their separate fractions in diesels. Figures 3; Tables 5; References 5 Russian.

USSR UDC 629.78.015:536.24

FREELY-CONVECTIVE HEAT EXCHANGE AND RESISTANCE OF A HEATED SPHERE IN LIQUID-DROP MEDIA

Khabarovsk SAMOLETOSTROYENIYE I AVIATS. TEKHN. in Russian 1975 pp 105-112

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.88]

KOLYKHALOV, G. A., and LOSHMANOV, YU. S.

[Text] A problem is formulated and solved concerning natural-convective heat exchange and resistance of a sphere with laminar boundary layer near

the walls. The solution is done by the method of successive approximations and is limited to two approximations. The value of viscosity is taken to be the mean-integral with respect to the thickness of the boundary layer. Criterial relationships are found for the coefficient of heat exchange and natural convective resistance. Table 1; References 7.

USSR UDC 629.78.015:536.333

STATIONARY DISTRIBUTION OF TEMPERATURE IN A THIN EMITTING RADIATOR FOR AN ARBITRARY DISTRIBUTE LAW OF HEAT-EMITTING ELEMENTS THEREUPON

Moscow KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY in Russian 1976 pp 70-75

[From Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.91]

NAUMOV, V. K., and TSAREVSKIY, S. N.

[Text] The problem of stationary distribution of temperature in a thin emitting radiator is studied. Nonlinear boundary Neuman problems and the condition for its solvability for a Laplace equations with respect to the unknown temperature distribution are formulated. Results of numerical calculations of the temperature field are presented. Illustrations 3; References 3.

USSR UDC 621.184.22:533.6

A STUDY OF HYDRODYNAMIC DRAG OF ALTERNATING ROWS OF PIPES WITH TRANSVERSE FLOW AROUND THEM

TR. LENINGR. KORABLESTROIT. IN-TA in Russian No 101, 1975 pp 34-37

[From REFERATIVNYY ZHURNAL TURBOSTROYENIYE No 12, 1976 Abstract No 12.49.50]

IVANOV, O. F., PROMYSLOV, A. A., and SHILOKHVOSTOV, A. V.

[Text] In planning compact heat exchange apparatus, one must have detailed dependences of the hydrodynamic drag of the tube bundle on the parameters of placement of the tubes. To do this, a systematic series of studies of the hydrodynamic drag of 17 tube bundles was undertaken, with various geometric parameters. (With identical relative diagonal step $S_2^r/d=1.25=const$ -- the minimum from the strength conditions of the rolled joints and variable S_1/d). The studies were performed on a hydraulic modeling installation. The data produced can be used to plan heat exchange apparatus of various types. Figure 1; Table 1; References 3.

USSR UDC 532.55:532.529.5.001.5

INVESTIGATION OF LOCALIZED HYDRAULIC DRAGS IN THE CORE MODE OF FILM BOILING

[TRUDY] MOSKOVSKOGO AVIATSIONNOGO INSTITUTA [(Transactions) of Moscow Aviation Institute] in Russian No 351, 1976 pp 76-82

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 12, 1976 Abstract No 12G52 by G. B. Rybchinskaya]

KALININ, E. K., KOCHELAYEV, YU. S., and SDOBNOV, G. N.

[Text] An experimental study is done on localized hydraulic losses on pipes with soldered-in diaphragms in the case of lifting motion of liquid. The experiments were done in unsteady conditions with cooling of the working section from 1000 K by turbulent flow of liquid nitrogen heated to the saturation temperature over the following range of parameters: inlet pressure 2-12 kgf/cm^2, liquid flowrate 0.15-0.7 kg/s, underheating 2-25 K. Time recordings were taken of the temperature of the outer surface of the working section (in 12 cross sections lengthwise), flowrate, pressure and temperature of the liquid at the inlet, pressure and pressure differential across the diaphragm (in 4-6 cross sections). The parameters of the two-phase medium were determined from the solution of a system of homogeneous equations describing the model of the core mode of film boiling. The

results are given in the form of curves for the coefficient of localized hydraulic losses as a function of time, mean temperature head behind the diaphragm, and volumetric steam content at the inlet to the diaphragm. A generalizing curve is proposed for the coefficient of hydraulic losses as a function of volumetric steam content and the dimensionless density of the steam. Figures 6; References 2.

USSR UDC 532.528:621.671

THEORETICAL DETERMINATION OF THE PRESSURE AND VOLUME OF CAVITATION POCKETS IN ROTARY CENTRIFUGAL PUMPS IN THE ABSENCE OF RETURN CURRENTS

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 5, 1976 pp 129-138 manuscript received 27 Feb 75

PILIPENKO, V. V., Dnepropetrovsk

[Abstract] In this paper an attempt is made to arrive at a precise solution to the problem of cavitational streamlining by a potential flow of a beveled grating of flat semi-infinite plates taking into account energy losses when the fluid enters the channels of the impeller between its blades in a rotary centrifugal pump. Based on this solution theoretical curves are obtained expressing the relationship between the volume of cavitation pockets on the blades of the impeller and the pressure in the inlet in the absence of return currents. This relationship is used to calculate the "pressure" of cavitation pockets and cavitation resistance when the fluid enters the channels of the impeller between its blades. This relationship determines to a considerable extent the dynamic properties of a supply main - pump system. Theoretical curves are derived, expressing the dependence of the pressure and volume of cavitation pockets on the cavitation coefficient and operating conditions of the pump, such as angle of attack and adjustment of the blade. It is shown that the height of a cavitation pocket, and consequently its volume, depends on energy losses when the fluid enters the channels of the impeller between the blades. Contours of a cavitation pocket with different cavitation coefficients are plotted from calculations. In calculating the area of a cavitation pocket a model is suggested which makes use of a semi-empirical correction factor which conforms to flow conditions prior to cavitation collapse. Formulas are given for calculating the total volume of cavitation pockets on the blades of the impeller. It is shown that this figure is proportional to the volume of the through section of the impeller, where the pockets are situated prior to collapse of cavitation. Equations for the relationship between the total volume of cavitation pockets and the cavitation coefficient and operating conditions of the pump are used to determine the relationship between variations in volume and variations in pressure and flowrate at the pump's inlet. Theoretical and experimentally derived relationships are shown to agree satisfactorily. Figures 5; References 6 Russian.

USSR UDC 532.517.4

APPROXIMATE THEORY OF NEAR-WALL TURBULENCE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 227, No 1, 1976 pp 67-70

GOL'DSHTIK, M. A., and SHTERN, V. N., Institute of Heat Physics, Siberian Division of the USSR Academy of Sciences, Novosibirsk

[Abstract] Finding the turbulent motion of an incompressible liquid along an unbounded plane on which the conditions of adherence are imposed and the mean frictional stress is assumed, is the problem examined: specifically, determining the mean velocity profile in the entire flow region without relying on empirical data, but by calculating pulsational motion in the viscid zone and the smooth adjoining of the solution to asymptotic functions far from the wall.

USSR UDC 532.529.6

SCHEME OF COLLAPSE OF CAVITATION BUBBLE AT A WALL AND THE FORMATION OF SMALL JET

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 227, No 1, 1976 pp 63-66

VOINOV, O. V., and VOINOV, V. V.

[Abstract] The damaging effects of cavitation are better understood by examining the collapse of bubbles in a liquid. Contrary to the assumed spherical shape of the cavitation bubble, its initial shape is now taken to be ellipsoidal, in an ideal incompressible liquid bounded by a plane. At the beginning of the study the liquid is assumed still and the pressure difference at infinity and in the cavity is constant and assumed greater than zero. Bubble shape changes as the cavitation bubble collapses and is narrowed at the upper free surface (not facing the wall) are described.

USSR UDC 532.528:620.193

INFLUENCE OF VELOCITY OF A STREAM ON THE INTENSITY OF CAVITATION EROSION

8-y SIMPOZ. MAGI. SEKTS. PO GIDROMASHINAM, OBORUD. I KAVITASII in Russian 1976 Leningrad, 1976 pp 318-336

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 12, 1976 Abstract No 12.49.219 by L.P.A.]

VEREMEYENKO, I. S.

[Text] A theoretical analysis is made of the influence of the dimensions of cavitation bubbles and their concentration on the degree of erosion of the material. Results are presented from experimental work on cavitation erosion performed on a cavitation test stand of the Hydraulic Turbine Laboratory of the KhTGZ Plant using models of the drive wheels of a reversible hydraulic turbine and the acoustical method of velocity erosion with easily damaged varnish coatings; drive wheels 500 mm in diameter with a speed in the pumping mode of 170 rpm and a model drive wheel 400 mm in diameter with a high pressure RO-230 hydraulic turbine and a speed of 185 rpm were tested. Based on the theoretical analysis performed and the experimental study of the influence of stream velocity on intensity of cavitation erosion in hydraulic machines, it is concluded that the intensity of cavitation erosion does not depend simply on the parameters of the stream (velocity, hydrostatic pressure and concentration of cavitation bubbles) and the parameters of the cavitation vapor-gas cavities (dimensions of cavitation bubbles and parameters of vapor-gas content). Figures 4; References 15.

USSR UDC 621.224:532.528:620.193

SOME RESULTS OF THE INVESTIGATION OF CAVITATION AND THE DYNAMICS OF HYDRAULIC TURBINES AND REVERSIBLE HYDRAULIC MACHINES

8-y SIMPOZ. MAGI. SEKTS. PO GIDROMASHINAM, OBORUD. I KAVITASII in Russian 1976 Leningrad, 1976 pp 337-356

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 12, 1976 Abstract No 12.49.218 by L.P.A.]

STARITSKIY, V. G., BUSYREV, A. I., BOL'SHAKOV D. S., UMOV, V. A., and ZUBAREV, N. I.

[Text] Results are presented from studies of film cavities on cylindrical and twisted vanes in stable and unstable streams. An estimate is made of the influence of the inaccuracy of installation of blades in the drive wheel on

cavitation erosion. Tests were performed in a cavitation pipe with a cross section of 100x165x350 mm with a maximum flow speed of 24.5 m/s. In order to create unstable flow in the pipe, beyond the gage section a special adaptor was installed. The water temperature in the tests was varied from 17 to 23°C, total air content 1.2 to 1.9%. Five versions of vanes were tested (4 had a symmetrical TSAGI V12 profile, one an asymmetrical V-8 profile). The influence of time and delivery apparatus closure rule following drive loss and load dropout on dynamic pressure, angular velocity and hydrodynamic loads during the transient process was determined. Figures 14; References 6.

USSR UDC 536.531

A PNEUMATIC RADIATION RECEIVER

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 96 Item No 535471

SALL', A. O.

[Text] A penumatic radiation receiver containing a body, window, radiation-receiving cavity with radiation-absorbing gas, microphone and ballast cavity, is distinguished by the fact that to increase selectivity, it includes a circular mirror screen, and the window is made in the form of a section of a paraboloid or ellipsoid of rotation with a mirror surface, for example a metallized surface, and the screen is located in the center of the flat portion of the window, and its diameter is equal to the diameter of the radiation-receiving cavity, located within the window, the radius of the radiation-receiving cavity r, input radius of the window R and distance from peak of mirror surface of the window to its focal point F are related by the following relationship $0.5\sqrt{rR} \leq F \leq 0.35R$.

USSR

UDC 621.187.12.001.5

THE STUDY OF THE VARIATION OF THE SALT CONTENT IN THE RETURN CYCLE OF THE WATER SUPPLY FOR THE WET DUST TRAPPING SYSTEMS

Moscow SAN. TEKHNIKA. RESP. MEZHVED. NAUCH.-TEKHN. SB. [Sanitary Engineering. Republic Interdepartmental Scientific and Technical Collection] in Russian 1976 No 16, pp 76-78

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11R91 by B. N. Kholyrev]

GRABAREVA, S. D.

[Text] A series of experiments were performed under laboratory conditions with respect to the circulation of slurry water in a closed cycle with the application of a headless hydrocyclone as the clarifying device. A study was made of the variation of the total salt content as a function of the contact of the dust with the circulating water and the quantitative transition of the soluble compounds from the slurry to the water. The slurry water contained dust with a disperseness of less than 56 microns. The concentration of the solid phase in the suspension was 20 g/kg; the water temperature was 15°C. Provision was made for 30 percent makeup of pure water, compensating for losses in the system and also a combined reagent treatment of the slurry water with wine and polyacrylamide. It was demonstrated that in this case the total salt content of the water did not exceed the admissible bounds and was within the limits of 300 to 400 mg/kg; the total chloride and sulfate content causing stability of the circulating water decreases as a result of constant removal of the precipitate from the system. On inclusion of the open hydrocyclone in the circulating system as the clarifying device, the formation of dense deposits and significant increased corrosion properties of the water are not observed. Tables 3; References 3.

USSR

UDC 621.23

INFLUENCE OF THE POSITION OF A HIGH-HEAD NOZZLE ON THE OPERATING EFFICIENCY OF AN EJECTOR

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 5, 1976 pp 122-128 manuscript received 22 May 75

USANOV, V. V., and ROZENOER, T. M., Moscow

[Abstract] The purpose of this paper was to study the influence of the position of the high-head nozzle for ejectors with a cylindrical mixing

chamber and with a geometrical parameter, a, on the order of 22, where a equals the ratio of the areas of the outlet sections of the high- and low-head gas nozzles, corresponding to a ratio of the areas of the wall sections of the cylindrical chamber and working nozzle at its point of construction equal to 80. A study was made of a microejector with a supersonic high-head nozzle whose critical cross-sectional diameter measures 0.64 mm and the diameter of its outlet section 1.22 mm. Its cylindrical mixing chamber has a 13-gauge relative length, proven close to optimum by preliminary studies. The position of the nozzle was varied by means of an intermediate bushing so that the distance from the section of the high-head nozzle to the beginning of the mixing chamber varied from 1.5 to 29.5 mm, or 1.23 to 24.2 times the diameter of the nozzle's outlet section. A special test stand was set up to measure the following: Air pressure in front of the high-head nozzle, in the low-head chamber, in the mixing chamber, and behind the ejector; rate of flow in the low-head line; and temperature. The flow-rate factor for the high-head nozzle had been determined experimentally beforehand. In studies conducted with the same initial temperatures for the gases to be mixed, a determination was made of the following dimensionless parameters of the ejector: Characteristic pressure ratio, degree of increase in pressure, ejection coefficient, and efficiency. A measurement was also made of the distribution of static pressure along the length of the mixing chamber and at its outlet. Experimental results are given in the form of the relationship between the degree of increase in pressure and the ejection coefficient with the characteristic pressure ratio constant. Characteristic choking curves are also given for two positions of the high-head nozzle. A comparison is made between experimental results and the results of calculations made by different methods. The experimental results demonstrate that when the beginning section of the jet is positioned in the mixing chamber the choking characteristics of the ejector and its efficiency do not change. The position of the high-head nozzle has practically no influence on the functioning of the exit cone if the mixing chamber is of sufficient length. Worsening of the ejector's operation occurs when the beginning section of the jet is outside the mixing chamber, caused by changing the position of the high-head nozzle. In this instance the mixed jet interacts with the wall of the inlet section and this interaction is accompanied by the creation of turbulence at the inlet to the mixing chamber and by loss of the jet's energy. The ejector's maximum operating conditions are characterized by choking of the mixing chamber at its outlet. The velocity profile at the outlet of a 13-gauge mixing chamber does not depend on the position of the high-head nozzle under maximum operating conditions. Figures 5; Tables 3; References 13 Russian.

USSR UDC 681.2:621.822.5

ON THE OPTIMAL RATIO OF TECHNOLOGICAL ROUGHNESS PARAMETERS IN PRECISE INSTRUMENT ELEMENTS

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, NO 8, 1976 pp 119-123 manuscript received 5 Feb 76

PROTASOV, B. V., and GLAZKOV, V. P., Saratovskiy Polytechnic Institute

[Abstract] The interrelationship between the analogous surface parameters of the two objects in a junction as they affect friction and wear are considered. Equations are presented for wear volume in terms of frictional area and gap increase in terms of volume and area. The ratio of contact areas is inversely proportional to modulus of elasticity ratio and directly proportional to average arithmetic deviation of the microsurface. This leads to expressions for gap increase in terms of ratios of area, surface deviation and modulus of elasticity and for rate of wear. The calculations indicate that the aperature should be of a higher class of roughness than the pivot to reduce wear. This was confirmed experimentally. In the case of wear significantly exceeding the level to technological roughness, heat flow dispersion must be considered determinant, so that total wear in this case does not depend on technological roughness. Figures 2; References 7 Russian.

USSR UDC 697.1:536.2.001.57:621.311.22

INVESTIGATION OF THE HEAT EXCHANGE OF THE STATE REGIONAL HYDROELECTRICAL POWER PLANT WITH NONHEATCAPACITIVE WALL ENCLOSURES ON THE MODEL

Moscow SAN. TEKHNIKA. RESP. MEZHVED. NAUCH.-TEKHN. SB. [Sanitary Engineering. Republic Interdepartmental Scientific and Technical Collection] in Russian 1976 No 16, pp 56-59

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11S198]

KHMELYUK, K. D., TKACHUK, A. YA., and KILIMNIK, A. A.

[Text] A study is made of the calculation and the peculiarities of the experimental simulation of the thermal regime of the State Regional Hydroelectrical Power Plant building with 800 megawatt units. On the basis of the experimental data it is demonstrated that it is possible to use metal decking with rectangular stiffening ribs as the wall enclosures of the boiler room. The expediency of the application of a slit connector for the aeration of the boiler facility as insuring the best thermal regime of the State Regional Hydroelectrical Power Plant facility by comparison with other types of aeration connectors is demonstrated. Illustration 1; References 4.

USSR

UDC 621.165-531

REGULATING THE LOAD OF A POWER BLOCK WITH STEAM-PRESSURE OPTIMIZATION

Kiev AVTOMIZATSIYA TEPLOVYKH ELEKTROSTANTSII I ENERGOSISTEM [Automation of Thermoelectric Power Plants and Energy Systems, Collection of Works] in Russian, Izd-vo Naukova Dumka, No 9, 1975 pp 52-59

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.75]

TSEYTLIN, R. A., SHAPIRO, V. I., ZOLOTOV, I. F., GRITSANYUK, O. K., and PLAKSIN, O. T.

[Text] Maintaining an optimal pressure ensures an increase in economy of a turboplant. In comparison with regulation at a constant pressure the gain is: with a load of 50% of the nominal it is 24 kcal/kW·hour; with a load of 90% the gain is equal to 2 kcal/kW·hour. In comparison with regulation at a sliding pressure the gain with a load of 85% of the nominal is 6.3 kcal/kW·hour. The computational method permits obtaining only a qualitative analysis of the dependence of economy on pressure. The real characteristics of the regulating valves and regulating stages often differ substantially from the computed ones. To find the real dependences of the efficiency of the turboplant on the position of the servo motor and load, experiments were conducted on two blocks, No 8 and No 10 (TPP 210 boiler, Khar'kov Turbogenerator Plant K-300-240 turbine at the Zmiyevsk State Regional Electric Power Plant). The turbine characteristics were determined purely experimentally (specific heat consumption measured by the method of direct balance) and by an experimental-computational means. Figures 2; Tables 2; References 8.

USSR

UDC 621.224-253.5:669.14

USE OF CAVITATION-RESISTANT STEELS FOR EXPLOSIVE PLATING OF HYDROTURBINE BLADES

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 50, 1975 pp 59-65

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.173]

BOGACHEV, I. N., TSEMAKHOVICH, B. D., RUDAKOV, A. A., APALIKOV, YU. I., KONON, YU. A., and BRONOVSKIY, G. A.

[Text] The problems laboratory of metal research of the Urals Polytechnic Institute imeni S. M. Kirov has developed, and suggested for explosive

coating of hydroturbine blades, a new cavitation-resistant martensite-hardening steel type 00KH12SH8MTYU (E17) of the maraging type. The authors give the characteristics and mechanical properties of sheet steel (hot-rolled sheet), the regimes of heat treatment, and also the comparative results of cleavage strength and cavitation resistance of 00KH12N8MTYU and KH18N10T steels after explosive plating. The cavitation resistance of the first steel in the explosion-coated state as a minimum is 2.5 times higher than the resistance of the second steel, which demonstrates the prospects of its use in hydroturbine design for parts of hydromachinery, subjected to a cavitation effect. The economy of manufacturing wheels of blades with one or two surfaces, coated with sheet cavitation-resistant 00KH12N8MTYU steel or one analogous to it, permits them to be used successfully instead of whole working wheels manufactured from stainless steel, upon retention or even increase in the lifetime of the machinery. Working wheels with these blades have been operating for 3 years without substantial wear. Tables 3; References 4.

USSR

UDC 621.791.3

A METHOD OF SOLDERING GRAPHITE

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 34 Author's Certificate No 533460 filed 14 May 75

ANIKIN, L. T., KRAVETSKIY, G. A., DERGUNOVA, V. S., and OSIPOV, YE. V.

[Text] This Author's Certificate introduces: 1. A method of soldering graphite with formation of a graphite seam. The technique involves introduction of an aluminum interlayer, pressing the parts together, heating the joint to the point where aluminum carbide forms and subsequent heat treatment that includes heating to the temperature of carbide dissociation and holding at this temperature to vaporize the aluminum and precipitate the secondary graphite in the seam. As a distinguishing feature of the patent the strength of the soldered joint at high temperatures is increased by heat treatment after soldering with cyclic heating and cooling in the temperature range of 1800-2300 $\pm$ 100-1800°C, the total duration of each cycle being 3-5 minutes. 2. A modification of this method with the distinguishing feature that five heat cycles are used.

USSR UDC 662.998(02)

TECHNOLOGY OF SHAPING LARGE REFRACTORY BLOCKS OF COMPLEX SHAPE

SBORNIK TRUDOV, VSESOYUZNYY NAUCHNO-ISSLEDOVATEL'SKIY I PROYEKTNYY INSTITUT TEPLOPROYEKT [Collection of Works. All-Union Scientific Research and Design Institute Teploproyekt] in Russian No 37, 1975 pp 3-12

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10S190]

OL'KHOVSKIY, I. A., TOROPOV, S. A., and LILA, B. S.

[Text] A technology has been developed for manufacturing large refractory parts with a volume of 0.4-0.6 m^3 with the use of vibroshaping of highly eroded masses, drying of the raw material by the method of electric osmosis and annealing. The parameters of vibroshaping were determined, which ensure the production of high-quality aluminum silicates and magnesia large refractory parts (vibration frequency 50-100 Hz, vibration amplitude 40-60 sec), using a hydraulic load with a force of 2-5 kGauss/cm^2. For organization of the experimental-industrial production of large refractory parts, an aggregate for casting at a productivity of 6 T/hour and a conveyor for drying the parts by the method of electric osmosis were planned. Figures 3; Tables 3; References 1.

USSR UDC 546.45:661.845:661.55

A METHOD OF PRODUCTION OF BERYLLIUM NITRIDE

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 pp 46 Item No 535217

TARATUNIN, P. I., and SOBOLEVA, N. A.

[Text] 1. A method of production of beryllium nitride by interacting metallic beryllium with a nitrogen-containing reagent with heating is distinguished by the fact that to reduce the temperature and accelerate the process, the nitrogen-containing reagent used is ammonium chloride, and the process is conducted at 450-550°C for 60-70 min.

2. A method as in Claim 1 is distinguished by the fact that to increase the purity of the product, the beryllium nitride produced is heated to 650-750°C and held for 20-40 minutes.

USSR UDC 536.2

HEAT EXCHANGE WITH TRANSVERSE FLOW AROUND FLAT OVAL TUBES

TRUDY MOSKOVSKOGO ENERGETICHESKOGO INSTITUTA [Transactions of Moscow Power Engineering Institute] in Russian No 283, 1976 pp 61-65

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 10, 1976 Abstract No 10.49.53 by L. P. A.]

BAKLASTOV, A. M., YEFIMOV, A. L., and GORBENKO, V. A.

[Text] The paper presents the results of an approximate theoretical and experimental study of heat exchange with transverse flow of a gas coolant around an isolated flat oval tube located at the inlet to a rectangular channel in the case of turbulent flow of a liquid coolant inside the tube. The average heat-transfer coefficient was experimentally determined by the method of regular conditions of the first kind with cooling of a flat oval aluminum rod with the following dimensions: rounding radius of the rectangular channel 5 mm, height 18.4 mm, height of the tube 2 mm, width 2.8, 5.0, 7.0, 10.0, 15.0 and 20.0 mm. The results of this study are approximated by a power law $N_u=0.44\ Re^{0.5}(L/d)^{-0.35}$ that is valid at Reynolds numbers in the range Re= 600-2000. A comparison of the approximate theoretical relation with experimental data showed that the greatest discrepancy occurs at $L/d=2-3$, amounting to 17%. When $L/d>1$ the discrepancy does not exceed 10% [sic]. The satisfactory agreement between the experimental results and the approximate theoretical solution shows the suitability of the proposed method of calculating heat exchange with transverse flow around an isolated flat oval tube or a single row of flat oval tubes if their mutual influence can be disregarded. Figures 3.

USSR UDC 621.18.02:621.185.5.004.2

FEATURES OF DRYING, HEATING AND USE OF BRICK LINING OF BOILERS WITH 500 AND 300 MW SETS

TRUDY VSESOSUZNOGO TEPLOTEKHNICHESKOGO NII. URAL'SKIY FILIAL [Works of the All-Union Heat Engineering Scientific Research Institute. Urals Branch] in Russian No 12, 1976 pp 10-15

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9R71 by R. L. Eygenson]

PESHEKHONOV, N. D., and DEGTEV, O. N.

[Text] The authors give the results of studying the features of drying, heating and using brick lining of P-57 and P-59 boiler furnaces with 500

and 300 MW sets. They found that fireclay-concrete of 2-layer slabs, from which the brick lining is made, has a rigid structure, insignificant penetrating porosity and weak water yielding capacity. Computation and production checking showed that drying and heating of the boilers with brick lining of 2-layer slabs may continue for no more than 2 days. Elevation in temperature of the concrete layer to 100-110°C and 140-150°C must be higher than 15°C per hour. Holding time in the first case is 20 hours, and 1 day in the second. Further elevation in temperature during heating of the boiler to working parameters must be accomplished at a rate no higher than 30°C per hour. Figure 1; Table 1; References 7.

USSR UDC 539.214;539.374

ON THE CONDITIONS OF GENERATING STRONG DISCONTINUITIES IN THE TWO-DIMENSIONAL PROBLEM OF FLOW OF RIGIDLY PLASTIC MATERIAL

Voronezh ISSLEDOVANIYA PO MEKHANIKE SPLOSHNYKH SRED [Investigations on the Mechanics of Solid Media, Collection of Works] in Russian No 3, 1974 pp 34-42

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V552 from the article]

KORZUNINA, V. V.

[Text] The author obtains the necessary conditions for creating strong discontinuities in the two-dimensional problem of flow of rigidly elastic material and orientation of surfaces, on which such creation is possible, on the basis of analyzing weak perturbations. The author assumes that on the surface of the weak discontinuities of the function there arises a strong discontinuity if the sudden jump in the first derivative in the direction of the normal to the surface tends to an unlimited value or is determined ambiguously on this surface. Then the jump in the function becomes nonzero, but its value is not determined from analysis of the weak discontinuities. Investigation by the described procedure of the equations of deformation of a rigidly plastic medium led to the following results. In the two-dimensional problem of flow of rigidly plastic material it is impossible to have the creation of strong discontinuities in velocities. On movable surfaces coinciding with the characteristics of the stresses, creation is possible only of strong discontinuities of stresses. The creation of strong discontinuities of strain is possible on fixed surfaces. in the same way the creation of strong discontinuities of stresses is possible.

USSR UDC 772.296:77.023.42

INVESTIGATION OF A PHOTOGRAPHIC PROCESS WITH SILVER-FREE PHYSICAL DEVELOPMENT ON TiO_2-BASED EMULSIONS

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 21, No 6, Nov/Dec 76 pp 431-437 manuscript received 12 Jun 75

KUNTSEVICH, N. N., SOKOLIK, G. A., and SVIRIDOV, V. V., Belorussian State University imeni V. I. Lenin

[Russian abstract provided by the source]

[Text] An investigation is made of the photographic properties of TiO_2 layers without additives and with the introduction of copper salts (10^{-8}-$5 \cdot 10^{-6}$ g/cm^2)

using silver-free physical development. The light sensitivity ($S_{0.2}$) of TiO_2-based emulsions that do not contain copper is 10^{-2} J/cm^2. Adding copper to the emulsions improves photographic properties and increases developing speed. The properties of copper-containing TiO_2 emulsions depend appreciably on the concentration of copper ions in the layer and the nature of the copper salt. The quantities $S_{0.2}$, D_{max} and γ as well as the developing speed reach a maximum when the copper content is 10^{-6} g/cm^2. The light sensitivity ($S_{0.2}$) of copper-containing emulsions ranges from $4 \cdot 10^{-3}$ to $7 \cdot 10^{-4}$ J/cm^2 depending on composition. Layers with Cu+ salts are characterized by higher light sensitivity than those with Cu^{2+} salts. The addition of CuBr gives layers with the highest light sensitivity ($S_{0.2}=7 \cdot 10^{-4}$ J/cm^2). An investigation is made of the stability of the latent image both on copper-containing emulsions and on layers without copper, as well as the influence that heating the layers before exposure (50-140°C) has on their properties. Figures 4; Tables 2; References 11: 7 Russian, 4 Western.

USSR UDC 621.362.2

HIGH-TEMPERATURE SOLDERS FOR COMMUTATION OF THERMOCOUPLES BASED ON LEAD CHALCOGENIDES

Tashkent GELIOTEKHNIKA in Russian No 5, 1976 pp 12-14 manuscript received 26 Jul 75

KAKHRAMANOV, K. SH., MAZUR, V. A., ROSHAL', R. M., and AKHMEDLI, G. T., "Order of the Red Banner of Labor" Institute of Physics, Special Design Office with Experimental Plant, Academy of Sciences Azerbaydzhan SSR

[Abstract] Lead chalcogenides and their solid solutions are effective materials for thermoelectric converters that operate at moderate temperature (300-700°C). An important factor in making such converters is prevention of chemical interaction between the semiconductor and the commutation material. The authors briefly discuss the properties of commutation materials that have an adverse effect on the efficiency of thermocouples. An investigation is made of the phase diagrams of the PbS(Se, Te) - Sb and PbS(Se, Te)-NiSb systems, and it is found that all these sections are quasibinary solid solutions of the eutectic type. The properties of these eutectics are tabulated. They all have high electrical and thermal conductivity in the 20-500°C temperature range and have excellent adhesion properties, making them attractive as commutation materials by reason of low thermal and electrical losses in the contact. Commutation solders of these eutectics will improve the efficiency, strength and durability of thermocouples based on lead chalcogenides. Figure 1; Table 1; References 9: 6 Russian, 3 Western.

USSR UDC 662.997.004.14:621.362

INVESTIGATION OF EPITAXIAL SILICON PHOTOVOLTAIC CELLS

Tashkent GELIOTEKHNIKA in Russian No 5, 1976 pp 3-5 manuscript received 9 Jun 75

MIRZABAYEV, M. M., RASULOV, K., TADZHIBAYEV, M., and ISKANDEROV, A., Physico-technical Institute imeni S. V. Starodubtsev, Academy of Sciences UzbekSSR

[Abstract] A study is done on the influence that various technological parameters have on the properties of silicon photovoltaic cells produced by one-sided (pn-junction) and two-sided (pin-structures) epitaxial growth of silicon with uniform dopant distribution. The epitaxial layers were grown by hydrogen reduction of $SiCl_4$ to a thickness of 1-20 μm on dislocation-free p-type and n-type silicon substrates. It was found that the dark current of photovoltaic cells based on pn-junctions behaves exponentially in the range of 10^{-5}-10^{-2} A/cm^2, while the inverse current is approximately proportional to voltage. The saturation current density is about 10^{-6} A/cm^2, and the rectification factor is of the order of 500 at 1 V. Maximum sensitivity is at a wavelength near 0.9 μm for an epitaxial layer with thickness ~10 μm, and shifts toward shorter wavelengths with a reduction in thickness. Studies of pin-structures with base region 100-700 μm thick showed that deep recombination centers in the base region have an appreciable influence on the photoelectric characteristics of the cell. These structures make efficient solar cells. Solar illumination of 80 mW/cm^2 yields efficiency of 7% in a solar cell with base thickness of 200 μm and area of 0.4 cm^2. The main parameters of photocells with base thickness of 100-400 μm at 300°C are as follows: open-circuit voltage 0.4-0.55 V, short-circuit current 20-32 mA/cm^2, efficiency for solar radiation of 80 mW/cm^2 7-11%, activity ratio of the current-voltage characteristic 0.6-0.8, rectification factor 10^5 at 1 V, and saturation current density 10^{-8} A/cm^2 without color coating. Figures 2; References 4 Russian.

USSR UDC 539.4:536.543

DUCTILITY AND STRENGTH OF PRECIPITATION-HARDENED ALLOY AT DIFFERENT TEMPERATURES AND STRAIN RATES

Kuybyshev TEZISY DOKLADOV VOS'MOY VSESOYUZNOY KONFERENTSII PO FIZIKI PROCHNOSTI I PLASTICHNOSTI METALLOV I SPLAVOV [Abstracts of Papers of the Eighth All-Union Conference on Physics of the Strength and Ductility of Metals and Alloys] in Russian 1976 p 227

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11V1239 by the authors]

STROKATOV, R. D., KARAVAYEVA, V. V., and SUKHOVAROV, V. F.

[Text] Studies were done on 36 NKhTYu alloy with the following composition: Ni--34.1, Cr--12.7, Mn--1.0, Si--0.27, C--0.03, Ti--3.09, Al--1.02 wt.%, and

the remainder Fe. The alloy was put through mechanical heat treatment resulting in a series of structures with grain size of 0.8-100 μm containing finely divided particles of γ'-phase. Special treatment gave states characterized by the presence or absence of dispersed carbide particles on the grain boundaries. Plate specimens were subjected to tension in vacuum at 600-1200°C with different strain rates set by a thyristorized electronic drive. It is shown that the way that ductility and resistance to deformation depend on temperature and strain rate is determined by the state of the grain boundaries and the stability of the structure.

USSR UDC 539.4:536.543

GRAIN-BOUNDARY SLIP AND DISLOCATIONS IN GRAIN BOUNDARIES

Kuybyshev TEZISY DOKLADOV VOS'MOY VSESOYUZNOY KONFERENTSII PO FIZIKE PROCHNOSTI I PLASTICHNOSTI METALLOV I SPLAVOV [Abstracts of Papers of the Eighth All-Union Conference on Physics of the Strength and Ductility of Metals and Alloys] in Russian 1976 p 90

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11V1236 by the authors]

KAYBYSHEV, O. A., and VALIYEV, R. Z.

[Text] An investigation was made of the effect of grain-boundary slip over a wide range of temperatures and deformation in MA8 magnesium alloy (Mg 1.5% Mn, 0.3% Ce, d_0 = 10 μm). An investigation is made of the interaction between dislocations and grain boundaries, and their behavior at elevated temperatures. It is shown that grain-boundary slip is most intense at 400°C. An important characteristic is the absence of substructure after hot deformation of the alloy, even though slip lines are clearly observable on the surface of the specimens.

USSR UDC 539.374;539.214

DUCTILITY OF HIGH-ALLOY STAINLESS STEELS

TRUDY. KRASNODARSKIY POLITEKHNICHESKIY INSTITUT [Transactions. Krasnodar Polytechnical Institute] in Russian No 83, 1976 pp 23-29

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11V431 by N. N. Beklemishev]

ZAYKOV, M. A., PERETYAT'KO, V. N., and SADCHIKOV, V. I.

[Text] An investigation is made of the influence that dopants and heating method have on ductility of chrome-nickel stainless steels (Kh17N13MGT,

Kh17N13MZT and Kh23N18) in the cast and prestrained state. Ductility was evaluated on cylindrical specimens by the hot twisting method.

It is shown that the addition of ferrocerium increases the ductility of steel at a temperature of 1000-1200°C and improves the quality of the rolled stock to some extent. Adding boron to Kh23N18 steel reduces the formation of macrodefects in ingots by improving ductility. Heating ingots of the investigated materials in a "stepped" schedule and rolling after one heat improves the surface quality of the rolled stock and enables a reduction in heating time.

USSR UDC 541.24:532.5

MECHANISM OF MASS TRANSFER WHEN CARBON INTERACTS WITH CARBON DIOXIDE AT HIGH TEMPERATURES (UP TO 2600 K) AND PRESSURES OF 1-40 ATMOSPHERES

SBORNIK TRUDOV, NAUCHNO-ISSLEDOVATEL'SKIY ENERGETICHESKIY INSTITUT IMENI G. M. KRZHIZHANOVSKOGO [Collected Papers. Scientific Research Institute of Power Engineering imeni G. M. Krzhizhanovskiy] in Russian No 42, 1975 pp 69-83

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B860 by I. V. Ioffe]

GOLOVINA, YE. S.

[Text] The author analyzes experimental results (which she obtained in a previous paper) relating to the rate of the reaction described in the title under the given conditions. A number of data indicate a four-stage mechanism, which is examined in detail. A formula for the rate constant of the reaction is found and simplified by the method of the equally accessible surface. The resultant expression is subjected to quantitative and qualitative analysis. The curve for the rate constant of the reaction as a function of pressure and temperature shows satisfactory agreement with experimental data. In particular, the author manages to explain observed anomalies and inhibition of the back reaction. References 12.

USSR UDC 533.6.011.8

GASDYNAMIC ASPECTS OF THE INFLUENCE THAT DEPARTURE FROM EQUILIBRIUM HAS ON FREE EXPANSION OF CARBON DIOXIDE

Novosibirsk DINAMIKA RAZREZHENNYKH GAZOV [Dynamics of Rarefied Gases, Collection of Papers] in Russian 1976 pp 134-149

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B320 by the authors]

PROKKOYEV, V. V., REBROV, A. K., and YARYGIN, V. N.

[Text] On the basis of measurements of local densities by the electron beam method, singularities in the expansion of carbon dioxide from an aperture are discussed in the stagnation temperature range of T_0=300-2800 K. It is shown that the distribution of relative densities in the region of free expansion is decisively influenced by condensation at stagnation temperatures close to room temperature, and by vibrational relaxation at higher temperatures. The limits of influence of relaxation processes are estimated with respect to the parameter P_0d at T_0=300 K (P_0 is the stagnation pressure, d is the diameter of the aperture). The experimental results are compared with calculations. References 17.

USSR UDC 621.039.536.2:621.039.53

HYDROGEN BRITTLENESS OF 15Kh3MFA STEEL UNDER IRRADIATION AND SOME PROBLEMS OF THE RELIABILITY OF THE HOUSINGS OF WATER COOLED REACTORS WITHOUT ANTI-CORROSION PROTECTION

Kiev V. SB. RADIATSION. EFFEKTY IZMENIYA MEKH. SVOYSTV KONSTRUKTS. MATERIALOV, I METODY IKH ISSLED. [Collection of Works: Radiation Effects of the Variation of the Mechanical Properties of the Construction Materials and Methods of Investigating Them] in Russian, Naukova Dumka, 1976, pp 68-77

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11U194 by G. I. Korotkina]

ALEKSEYENKO, N. N., KUZNETSOV, A. A., NIKOLAYEV, V. A., RAZOV, I. A., and USATOV, E. P.

[Text] The housings of the water cooled, water moderated nuclear reactors of the Soviet Atomic Electric Power Plants are made of low alloy 15Kh3MFA steel. The basic sources of hydrogen in the water cooled nuclear reactor system are presented: radiolytic decomposition of water and ammonia added

to the water as the corrosion and ammeter, the formation of hydrogen as a result of the nuclear (n, p) reaction, the generation of hydrogen at the steel-water interface as a result of corrosion of the housing material by the reaction: $3Fe + 4H_2O \rightarrow Fe_3O_4 + 8H \begin{cases} \rightarrow H_2 \rightarrow \text{to water} \\ \rightarrow \quad\quad \text{to metal} \end{cases}$. The presented results of the studies performed on 15Kh3MFA steel (0.14 percent C, 0.26 percent Si, 0.44 percent Mn, 0.019 percent S, 0.012 percent P, 3.0 percent Cr, 0.76 percent Mo and 0.31 percent V) indicate that the neutron irradiation essentially changes it corrosion resistance, absorption capacity and diffusion mobility of the hydrogen in the metal. As a result of the experiments performed it turned out that the neutron irradiation inhibits the recovery of ductility of the hydrogen-charged steel. The recovery of the ductility of hydrogen charged steel after irradiation at a temperature of 300-350°C coincides with the complete degassing of the metal. In a number of cases the reduction of the ductility is accompanied by a decrease in strength which with the hydrogen content of 4 to 5 cm^3 per 100 grams of metal can reach 19 kg-force/mm^2. An estimate of the effect of the neutron irradiation on the inclination toward slow destruction of 15Kh3MFA steel under the effect of hydrogen was performed on cylindrical rupture samples with an annular notch after irradiation with a dose of 10^{20} neutrons/cm^2 at a temperature of 300 to 350°C. The tests were performed on the devices with spring loaded for continuous cathode hydrogen charging in a 5 percent solution of sulfuric acid. Illustrations 5; References 17.

USSR UDC 620.197.1:626.822

CORROSION OF STEEL PIPELINES AND WAYS OF REDUCING IT

Moscow GIDROTEKHNIKA I MELIORATSIYA in Russian No 11, Nov 76 pp 38-42

UGRYUMOV, A. V., LOMAKIN, A. T., GOLUZIN, L. N., and FOMIN, G. YE.

[Abstract] Most metals corrode faster when periodically wetted than when totally immersed. Steel, for example, corrodes in a water film 2-3 times more than in a water medium. The rate of tubercular and pitting corrosion of steel structures in river water varies from 0.12 to 1.2 mm a year, when the total change in chlorine and sulfate concentrations varies from 2.0 to 74.8 mg/liter. Ethynol coatings--a by-product of chloroprene rubber--are in proven satisfactory use in the shipbuilding industry. Ten years is the service life found for ethynol used on pressure pipes at the Ust'kamenogorsk Hydroelectric Power Station. One disadvantage of ethynol coatings is the low resistance to light and atmospheric ageing.

USSR UDC 621.187.128:628.162:628.3.004.2

EXPERIENCE IN USING THE CARBOXYL CATIONITE KB-4-2P FOR NEUTRALIZING DISCHARGE WATERS FROM A DESALINATION DEVICE FOR NATIVE WATER AND MODULAR DESALINATION DEVICES

Moscow TRUDY 2-GO VSESOYUZNOGO NAUCHNO-TEKHNICHESKOGO SOVESHCHANIYA PO TEME: "PROBLEMY BOR'BY S ZAGRYAZNENIYEM VODOISTOCHNIKOV STOCHNYMY VODAMI TEPLOVYKH ELEKTROSTANETS" [Works of the Second All-Union Scientific Technical Conference on the Subject: "Problems of Combating Contamination of Water Sources by Standing Waters From Thermoelectric Power Plants"] in Russian 1976 pp 75-76

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 9, 1976 Abstract No 9R107 by B. N. Khodyrev]

MAKARCHUK, L. F.

[Text] The carboxyl cationite has been used at the Berezov State Regional Electric Power Plant since 1971 for neutralizing acid and alkali waters after regeneration of anionite and H-cationite filters of a desalination device for native water and a hopper directing device. The amount of H_2SO_4 discharged per month with repeated utilization comprises 2500 kg; the amount of NaOH discharged is 3T. A bottleneck in the use of the KB-4-2P cationite as the load of filter-neutralizers of discharge waters for the desalination device of native water is the gypsiferization of the cationite during the admission of the acid regenerators. But the choice of the proper regime of using this filter (loosening by air, treatment by ultrasound, creation of constant circulation, etc.) permits reducing to a minimum the material losses due to gypsiferization. After 3 years of use from 8.7 T of the carboxyl cationite KB-4-2P the losses comprised 2.4 T at a cost of 7800 rubles. The annual expenditures for neutralization of the discharge waters with a productivity of 170 T/hour and modular 600 T/hour desalinating devices comprise 2500-3000 rubles. [Ber4zov State Regional Electrical Power Plant].

USSR UDC 629.7.036.3:621.822

INFLUENCE OF REACTIVE FUELS ON DURABILITY OF ROLLING SURFACE BEARINGS

PRIMENENIYE KONTAKT. GIDRODINAMIKI K ISSLED. DETALEY MASHIN No 3 in Russian Kubyshev 1976 pp 146-154

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 10, 1976 Abstract No 10.34.66 from the resume]

BORODIN, A. YE., LITVINOV, A. A., and KOROLENKO, YU. I.

[Text] Results are summarized from laboratory studies of the influence of fuels on the fatigue durability of structural metals. The studies were

performed on an installation, the friction unit of which is a Number 8204 thrust bearing. The following test conditions were selected: speed n=1360 rpm; fuel temperature T=20-25 C. The criterion for evaluation of the fatigue durability of the rolling surface bearings was the durability corresponding to 50% probability of failure. Physical and chemical properties of fuels selected for study are presented. The results of the studies show that the level of influence of reactive fuels on fatigue durability is determined to a great extent by their chemical composition, primarily the presence of summary adsorption resins, i.e. surface-active substances, the fatigue durability of bearings increasing with increasing content of these resins in the fuel. Figures 2; References 10.

USSR UDC 621.175:620.193.001.42

ACCRETION AND CORROSION IN CONDENSERS AND HEAT EXCHANGERS COOLED BY SEA WATER

Moscow ELEKTRICHESKIYE STANTSII in Russian No 9, Sep 76 pp 69-71

KAYGORODOV, M. M., engineer, Sverdlovsk, Arkhangel'skaya Oblast

[Abstract] The article gives the results of a study of accretion and corrosion in tubes made from LAMsh 77-2-0.06, MNZH 5-1 and MNZHMts 30-1-1 alloys in heat exchange equipment with cooling water flowrates from 2 to 5 m/s. The coolant used was sea water heavily contaminated with oils, fats and petroleum products (up to 120 mg/kg), wastes, suspensions and abrasive impurities (up to 187 mg/kg), with salt content up to 21.2 thous. mg/kg and chloride content up to 11.8 thous. mg/kg. Stand tests and industrial operation of condensers and heat exchangers using contaminated sea water in periodic operation and cyclic heat loads showed that LAMsh 77-2-0.06 and MNZH 5-1 alloy tubes are unsuitable for any cooling water flowrates. At elevated flowrates limited by the amount and kind of contaminated sea water, wear of the inside surface of the tubes and hydraulic drag of the condensers and heat exchangers, it is advisable to use tubes of MNZHMts 30-1-1 alloy to improve the reliability of equipment. Contaminants and sea water that might cause intense corrosion of cupronickel tubes should be blown out with compressed air after every stop and before the condensers and heat exchangers are put into operation. Figures 3; Table 1; References 5 Russian.

USSR UDC 662.75.093.7

STUDY OF THE PROCESS OF DEOXIDATION OF FUEL IN CONTAINERS

EKSPLUAT. SVOISTVA TOPLIV, SMAZOCH. MATERIALOV I TEKHN. ZHIDKOSTEY, PRIMENYAYEMYKH V GRAZHD. AVIATSII in Russian No 1, Kiev 1975 pp 65-67

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 10, 1976 Abstract No 10.34.25 from the resume]

LOGVINYUK, V. P., MALYSHEV, V. V., ASTAF'YEV, V. A., and BORISOV, V. D.

[Text] A study is made of the process of liberation of dissolved oxygen from T-8 fuel when nitrogen is fed through it. The tests were performed in a 0.25 m^3 tank. Gas feed was through nozzles 0.5 and 1 mm in diameter at a pressure of 0.4 kg/cm^2, fuel volume 0.2 m^3, nitrogen flow rate 0.01 m^3/min. The concentration of oxygen in the fuel in 10 minutes decreased from 4.5 to 0.8 vol.%, and in 20 minutes -- to 0.5 vol.%. The relative nitrogen consumption required to reduce the oxygen concentration to 0.5 vol.% at a pressure of 0.4 kg/cm^2 is about 1 m^3 nitrogen/m^3 fuel, where the volume of gaseous nitrogen is adjusted to standard temperature and pressure. Figures 2.

USSR UDC 533.583

A NEW HIGHLY EFFECTIVE ADSORBENT FOR SORPTION SUPERHIGH VACUUM CRYOPUMPS

VOPR. ATOM. NAUKI I TEKHN. SER. FIZ. I TEKHN. VYSOKOGO VAKUUMA in Russian No 1 (5) Khar'kov 1976 pp 42-46

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 12, 1976 Abstract No 12.34.111 from the resume]

MAKSIMOV, S. P., KRAVTSOVA, V. P., GASHIN, V. M., GUR'YANOV, V. V., SHCHERBAKOV, V. P., MISIN, M. S., and SIZOVA, G. P.

[Text] For the first time, a polymer material has been used to develop a new high efficiency adsorbent -- a cryosorbing carbon material (KUT) for superhigh vacuum sorption cryopumps. The adsorbent has a structure with a well-developed micropore volume and is characterized by high adsorption and physical-mechanical properties. In the process of development, the influence of structural parameters on the adsorption capacity for nitrogen at 77 K is studied in the range of equilibrium pressures of 10^{-8} to 760 mmHg. It is shown that the best experimental specimen No 5 has an adsorption capacity for nitrogen at $P<1\cdot10^{-3}$mmHg exceeding the adsorption capacity of commerical

carbon type SKT-2 by more than an order of magnitude. The first experimental pilot batch of KUT-1 adsorbent for sorption superhigh vacuum cryopumps in experimental thermonuclear and other installations has been produced. Figures 4; Tables 2; References 11.

USSR UDC 539.4

INFLUENCE OF NEUTRON BOMBARDMENT ON DEFORMATION RESISTANCE AND BRITTLE RUPTURE OF STEEL

RADIATSION. EFFEKTY IZMENENIYA MEKH. SVOISTV KONSTRUKTS. MATERIALOV I METODY IKH ISSLED. in Russian, Kiev, Nauk. Dumka Press 1976 pp 77-84

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12V1116 by V. N. Geminov]

VAYNER, L. A., and RAZOV, I. A.

[Text] Experiments were conducted using 15KhMFA steel, hardened and high tempered, and A533 steel. Smooth specimens and specimens with mechanical notches and fatigue cracks were used. Bombardment was performed in the VVR-M reactor in doses of up to $9 \cdot 10^{19}$ n/cm^2 at E>1 MeV. Neutron bombardment increases the yield point (by increasing the athermal component) but does not change the brittle strength or rupture resistance at zero plastic deformation, which causes an increase in the critical brittleness temperature. Right up to a certain level of radiation damage (defined by the radiation resistance of the steel), the influence of neutron bombardment on the temperature dependence of rupture ductility K_{Ic} can be considered by parallel shift of the curve $K_{Ic}=f(T)$ into the area of high temperatures by the displacement of the critical brittleness temperature, determined by the standard method (impact testing). At high levels of radiation damage, additional rotation of the curve of K_{Ic} is possible, leading to an additional increase in the viscous-brittle transition temperature. References 6.

USSR UDC 539.4

SENSITIVITY OF DUCTILITY OF CADMIUM TO STRESS STATE PLAN WITH VARIOUS TEMPERATURE-VELOCITY CONDITIONS OF DEFORMATION

TR. GOR'KOV. POLITEKHN. IN-TA in Russian Vol 31, No 10, 1975 pp 23-28

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 12, 1976 Abstract No 12V1132 by A. A. Fortunin]

KIPARISOV, A. G., and SKUDNOV, V. A.

[Text] A study is made of the sensitivity of ductility of cadmium to the stress state plan at various temperature-rate deformation conditions. Static testing is performed by the known method and dynamic testing is performed on a pendulum hammer with an attachment for extension of gagarin quintuple specimens (Standard GOST 1497-73) and notched specimens 6 mm in diameter made of technical cadmium. The range of change of temperatures T=0.4-0.8 mp at deformation rates of $2\cdot10^{-2}$, $2\cdot10^{-1}$ and $1.5\cdot10^{+2}$ sec^{-1}. It is established that an increase in rigidity of the stress state diagram reduces the overall level of ductility of cadmium in the range of rates $2\cdot10^{-2}$-$1.5\cdot10^{+2}sec^{-1}$, while the sensitivity of the ductility of cadmium to the rate increases with an increase in the exponent. The influence of the stress state plan on the temperature-velocity dependence of ductility of cadmium was explained from the standpoint of occurrence of stress relaxation and the change in level of residual stresses upon plastic deformation. References 6.

USSR UDC [697.33+697.328].001.5

USE OF THE AG-4 PRESSURIZING LIQUID FOR PROTECTING DEAERATED WATER IN ACCUMULATOR TANKS OF THE HEAT GRID FROM AERATION

TRUDY VSESOYUZNOGO NAUCHNOGO-ISSLEDOVATEL'SKOGO I PROYEKTNO-KONSTRUKTNOGO INSTITUTA VNIIENERGOPROM [Works of the All-Union Scientific Research and Structural Design Institute VNIIenergoprom] in Russian No 7, 1975 pp 53-61

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10S169]

YAKOVLEV, D. A., SHEREMETOVA, A. A., SAVIN, V. I., PRAKHIN, A. F., ZEL'TSER, V. YE., SAZONOV, R. P., GOROKHOVA, L. G., NOVIKOV, YU. V., and LASTOCHKINA, K. O.

[Text] In contact with air the concentration of oxygen dissolved in water grows by 1.5-10 times in comparison with that allowed by the norms -- 50 mkg/kg. In testing samples of No 3 steel in water at a temperature

of 90°C, it was established that an increase in oxygen concentration in water up to 70-100 mkg/kg causes a loss in mass of the metal from 0.9 to 4.0 g/m^2; here the respective rate of local destruction will be from 1 to 4.5 mm/year. Taking into account the nonequilibrium character of the formation of corrosion of the pipeline walls, the appearance of the first through airholes (with a wall thickness of 8 mm) should be expected after 1.7-8 years rather than the 30-40 years established by the norms. Development has been made of a pressurizing liquid AG-4 and a device, which prevents the entry of the liquid from the vessel with water during pumping of the latter into the pipeline of the grid. The composition of the AG-4 is a liquid with a low specific weight, high gas impermeability and viscous-mobile properties, due to which it creates on the surface of the evaporation mirror a constantly floating protective screen with a layer thickness of 2-4 cm. Figures 3; Tables 2; References 8.

USSR UDC 620.197.6+620.197.626/.627

SELECTION OF LACQUER COATINGS FOR ANTICORROSION PROTECTION OF METAL STRUCTURES OF HYDROELECTRIC POWER PLANTS

TRUDY KOORDINATSIONNOGO SOVESHCHANIYA PO GIDROTEKHNIKE [Works of the Coordination Conference on Hydraulic Engineering] in Russian No 100, 1975 pp 195-198

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.4.169]

PETROV, YU. S.

[Text] The author discusses the results of selecting coatings for anticorrosion protection of metal structures of hydroelectric power plants which satisfy the requirements of prolonged and reliable protection under various operating conditions. The investigations were conducted under laboratory and field conditions, and on operating equipment at a hydroelectric power plant. The most effective anticorrosion coatings for these purposes were found to be those on a base of KHS-720 and KHV-74 paints, deposited on VL-02 or VL-023 rustproofing prime coats. Figures 2; Table 1.

USSR UDC 620.169.1

THERMOCYCLICAL LIFETIME OF THE EI437B ALLOY

Kiev NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH GAZOTURBINNYKH DVIGATELYEY [Reliability and Lifetime of Aviation Gas-Turbine Engines, Collection of Works] in Russian No 2, 1975 pp 31-35

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.100]

ALYAB'YEV, V. V.

[Text] The author examines a procedure for determining the thermofatigue characteristics of EI437B alloys during symmetrical and asymmetrical cycles of change in thermal stresses. The samples were tested under conditions of a sawtooth-shaped change in tempeature of the cycle. The obtained data of thermocyclical lifetime for fixed values of the probabilities of fracture were processed using an apparatus for nonlinear instantaneous correlation. Figure 1; References 2.

USSR UDC 629.7.036.3-226

INVESTIGATION OF THE LIFETIME OF TURBINE BLADES MADE OF A DEFORMABLE HEAT-RESISTANT ALLOY

Kiev NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH GAZOTURBINNYKH DVIGATELYEY [Reliability and Lifetime of Aviation Gas-Turbine Engines, Collection of Works] in Russian No 2, 1975 pp 3-11

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.39 resume]

MILOV, YE. A.

[Text] The author cites the results of an investigation of the working blades of turbines made of the alloy ZHS6-KP based on the parameter "residual lifetime." The experimental investigations were conducted both on older blades and on new ones with preliminary fatigue loading. Figures 10; References 4.

USSR UDC 536.631(083.76)(083.74)+536.631.089.6(083.74)

STATE SYSTEM FOR UNIFICATION OF MEASUREMENTS. STATE SPECIAL REFERENCE MEASURE AND SOVIET-WIDE VERIFICATION SYSTEM FOR FACILITIES THAT MEASURE THE SPECIFIC HEAT OF SOLIDS IN THE TEMPERATURE RANGE OF 4.2-90 K

USSR STANDARD, GOST 8.180-76 in Russian

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 10, 1976 Abstract No 11.32.806S]

[Text] This Standard covers a State special reference measure and Soviet-wide verification system for facilities that measure the specific heat of solids over a temperature range of 4.2-90 K, and establishes the designation of the State special reference measure of the unit of specific heat of solids in the 4.2-90 K temperature range as the joule per kilogram-kelvin [J/kg·K]. The Standard also covers the set of basic measurement facilities that make up the special reference measure, the principal metrological parameters of the measure, and the procedure for transferring the specific heat unit from the special measure via secondary measures and laboratory measurement facilities to working measurement facilities with indication of errors and basic methods of verification.

USSR UDC 531.787.7:006

STATE SYSTEM FOR UNIFICATION OF MEASUREMENTS. STATE SPECIAL REFERENCE MEASURE AND SOVIET-WIDE VERIFICATION SYSTEM FOR FACILITIES THAT MEASURE PRESSURE DIFFERENCE UP TO $4 \cdot 10^4$ N/m^2

USSR STANDARD, GOST 8.187-76 in Russian

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.616S]

[Text] This Standard covers a State special reference measure and a Soviet-wide verification system for facilities that measure pressure difference up to $4 \cdot 10^4$ N/m^2, and establishes the designation of the State special reference measure of the pressure unit for pressure difference from 0.1 to $4 \cdot 10^4$ N/m^2 as the pascal [Pa = 1 N/m^2]. The Standard also covers the set of basic measurement facilities that make up the special reference measure, the principal metrological parameters of the measure, and the procedure for transferring the pressure unit from the special measure via secondary measures and laboratory measurement facilities to working measurement facilities with indication of errors and basic methods of verification.

USSR UDC 531.781(088.8)

A METHOD OF DETERMINING THE STIFFNESS OF THE SUSPENSION OF THE MOVABLE PART OF A MICROTORQUEMETER

USSR AUTHOR'S CERTIFICATE No 489971, filed 9 Apr 73, published 3 Mar 76 in Russian

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.434P]

SHENFEL'D, A. YA., BEZRYADIN, N. A., and SHENFEL'D, YA. E., Specialized Design Office No 1, "Gosmetr" Plant

[Text] To improve accuracy in the proposed method, the resonant frequencies f_1 and f_2 of the moving part with the arbor and with an arbor of reference mass m_0 respectively are measured at seat vibration amplitudes of no more than 40', and the stiffness C of the suspension is then calculated from the formula

$$C = \frac{4\pi^2 f_1^2 f_2^2 m_0}{f_1^2 - f_2^2}.$$

USSR UDC 389.14:53.083.8

METROLOGICAL SUPPORT FOR MEASUREMENT INFORMATION SYSTEMS

Moscow METROLOGICHESKOYE OBESPECHENIYE INFORMATSIONNO-IZMERITEL'NYKH SISTEM. TRUDY VNII FIZ-TEKHN. I RADIOTEKHN. IZMERENIY [Works of the All-Union Scientific Research Institute of Physicotechnical and Radio Engineering Measurements] in Russian No 25(55), 1975 76 pp

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.81]

[Text] This collection of works of the All-Union Scientific Research Institute of Physicotechnical and Radio Engineering Measurements is the first to be practically completely devoted to the problem of metrological support for measurement information systems. This can be explained by the ever increasing part played by such systems in present-day measurement technology. Because this is a relatively new topic, some of the papers are formulatory. Some propositions and methods of approaching problems of study can be applied with success not only in determining the metrological characteristics of measurement information systems, but also in designing them. The proposed system of State standards that normalize the metrological characteristics

of measurement information systems, when it has been supplemented for instance by documents that normalize the input and output signals of the separate components of these systems, could enable one to "put together" measurement information systems from components developed and produced by different ministries and agencies. Another problem of importance is accounting for the contribution to the total error of measurement information systems that is made by the errors of the computers that are component parts of the system. The collection also contains papers dealing with individual elements of measurement information systems that examine calculation of standard filter elements of many components of these systems.

USSR UDC 519.27.089.6

METHODS AND EQUIPMENT FOR CERTIFYING AND CHECKING CORRELOMETERS

Leningrad TEZISY DOKLADOV DEVYATOGO VSESOYUZNOGO SIMPOZIUMA 'METODY PREDSTAVLENIYA I APPARATURNYY ANALIZ SLUCHAYNYKH PROTSESSOV I POLEY, MINSK, 1976. SEKTSIYA 1' [Abstracts of Papers of the Ninth All-Union Symposium on Methods of Representation and Instrumental Analysis of Random Processes and Fields, Minsk, 1976. Section 1] in Russian 1976 pp 15-21

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.66 by P. N. A.]

KOTYUK, A. F., LEVCHENKO, D. G., and CHESNOKOV, YU. G.

[Text] The paper examines the problem of metrological support for correlation measurement techniques. Metrological support means selection of the reference correlation function, development of certification and verification procedures, and design of the appropriate verification equipment. A correlometer is treated as a multipurpose measurement device that must be certified and checked individually for a series of parameters that comprise the measurement result in a given instance. The authors propose a block diagram of a device for certification and verification of correlometers by the reference model method; a model is outlined that shapes a predetermined kind of correlation function from white noise. Figures 3; Table 1.

USSR UDC 621.181:662.613.5.001.42

DETERMINATION OF THE CONTENT OF CARBONACEOUS PARTICLES IN THE EXHAUST GASES OF POWER PLANTS

ENERGOMASHINOSTROYENIYE in Russian No 6, 1976 pp 31-32

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 12, 1976 Abstract No 12R28]

KONDRATOVA, A. A., TLYUSTANGELOVA, M. V., KORSAKOVA, I. S., SOSNINA, N. P., and PAVLOV, I. S.

[Text] The method of quantitative determination of carbonaceous particles (soot) in flue gases consists in catching the dispersed phase in absorption pipes with filtering material, and then determining the carbon in the sample by ultimate analysis of the organic compounds with respect to amount of carbon dioxide formed during combustion. Experiments were done on the PK-41 boilers of the Konakovskiy State Regional Power Plant burning grade 100 sulfurous fuel oil. In the center of the gas line preceding the convective steam superheater (gas temperature $\sim$900°C) the average content of carbonaceous particles at excess air ratios of 1.04 and 1.07 was 53 and 43 mg/m^3 respectively, which corresponds to an amount of unburned carbon of 608 and 510 mg per kg of fuel consumed. The average content of carbonaceous particles in samples taken beyond the water economizer was 21 mg/m^3. Data are given on nonuniformity of the distribution of carbonaceous particles with respect to cross section and length of the gas lines. Figures 3; Tables 2; References 7.

USSR UDC 624.131 + 539.215

EXPERIMENTAL STUDIES OF THE COMPRESSIBILITY OF SANDY SOILS AND OF CONDITIONS FOR PLASTICITY WITH TRANSIENT DYNAMIC LOADS

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 140-146 manuscript received 3 Nov 75

KOTOV, A. I., NAROZHNAYA, Z. V., RYKOV, G. V., and SUTYRIN, V. P., Moscow

[Abstract] The results are given of experimental studies of the compressibility of sandy soils with different moisture content and of the conditions for plasticity with transient dynamic loads, with the major emphasis on statistical evaluation of the results of measuring stresses and strains. Studies of specimens of sandy soils were made with a quasistatic unit, in the form of an upright cylinder containing a ring holding the soil sample, and a piston transmitting an impact load to the sample. Different conditions

for straining the samples were created by means of rubber washers and by changing the height from which the weight dropped. Static tests were also made. The experiments were repeated five times under identifical conditions. Stresses were measured with strain gages installed at the center of the piston, at the center and edge of the base of the cylinder, and on the side surface of the ring. The total force transmitted to the sample under impact was recorded with a sleeve-type strain gage. Strains in the samples were measured by means of three tensometric displacement gages installed at an angle of 120° and consisting of two brackets secured to the bottom half of the cylinder, between which was placed a key connected to the unit's moving piston. Strain gages whose signals are proportional to the piston's displacement were cemented to the brackets. It is demonstrated that conducting a series of experiments substantially increases measurement accuracy and makes it possible to confirm with a sufficient degree of certainty the conclusion obtained earlier, to the effect that the deformation rate has a substantial influence on the compressibility of sandy soils with a natural moisture content and that this factor has but a slight influence on the conditions for plasticity. Data was also obtained proving the substantial role of moisture content in the formation of viscous effects in sandy soils. Estimating the parameters of distribution functions when measuring stresses and strains with a unit of the quasistatic type and estimating the accuracy of these measurements makes it possible to make a quantitative estimate of the mechanical characteristics of different soils, taking into account their viscoplastic properties under transient dynamic loads. Figures 5; Table 1; References 8 Russian.

USSR UDC 539.1.074

THE PHYSICAL METHODS OF MEASURING THE EXPOSURE AND ABSORBED DOSAGE AND ACTIVITY OF THE CLOSED GAMMA RADIATION SOURCES IN THE LABORATORY OF METROLOGY OF RADIONUCLEIDES AT THE ATOMIC PHYSICS INSTITUTE

Moscow V. SB. METODY IZMERENIY I ISPYTANIY ZAKRYTYKH ISTOCHINKOV IONIZIRUYUSCH IZLUCHENIY [Collection of Works: Methods of Measurement and Testing of Closed Sources of Ionizing Radiation] in Russian, Atomizdat, 1976 pp 168-179

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1406]

REBIGAN, F., and SANDU, M. V.

[Text] A description is presented of the method of ionizing in a cavity based on the Bragg-Gray principle used for determining the absorbed dose in the activity of the closed ^{60}Co and ^{137}Cs sources. The calculation values are presented for these variables along with the corrections and

the measurement errors obtained when investigating the sources on the basis of the indicated isotopes with an activity from 2 to 50 millicuries. The lower limit of the measured activities is about 1 millicurie. The method permits standardization of the sources, the activity of which reaches hundreds of curies. Illustrations 6; Tables 2.

USSR UDC 548.734.(047)

THE SENSITIVITY OF THE X-RAY SPECTRAL ANALYSIS OF THE ELEMENTS WITH $10 < Z < 30$ ON EXCITATION OF THEM BY PROTONS WITH AN ENERGY OF 200 TO 400 KEV (SURVEY)

Kiev V. SB. SOVREM. PROBL. RAZVITIYA ANALIT. PRIBOROSTR. [Collection of Works: Modern Problems of the Development of Analytical Instrumentmaking] in Russian 1976 pp 78-78

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1016]

DMITRENKO, R. V., KOROBKO, G. S., and KOLYADA, V. M.

[Text] A brief survey of the theoretical experimental work with respect to the excitation of the internal shells of atoms by accelerated ions is presented. The outputs of the characteristic x-ray K-radiation from the Al, Ti, Co and Al-Co alloy samples bombarded by protons with an energy of 200 to 200 kev were measured. The calculations of the limiting sensitivities of the proton-x-ray analysis are presented for the measurements of the K-lines in the elements with $10 < Z < 30$ using the proportional counters under the conditions of the optimal bombardment and recording regimes for proton energies of 100 to 2000 kev. The atomic proportion of the impurity is within the range of 10^{-5} to 10^{-6} percent. Illustrations 2; References 11.

USSR UDC 543.272.68.332.6

PROBLEM OF DYNAMIC ACCURACY OF COMPLEX ELECTRONIC MODELS OF AUTOMATED GAS ANALYTICAL SYSTEMS

Kiev V. SB. SOVREM. PROBL. RAZVITIYA ANALIT. PRIBOROSTR. [Collection of Works: Modern Problems of the Development of an Analytical Instrumentmaking] in Russian 1976 pp 80-87

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.924]

SMORCHKOV, V. I., ZABAVA, V. P., and FEDYANIN, A. S.

[Text] A study is made of the models of complex transfer functions realized on one dc amplifier under the assumption that the four terminal networks which are in the input circuit and in the feedback circuit of the dc amplifier and have a ratio of the mutual conductivities equal to the given transfer function are not always physically realizable. As the source of errors, the scattering of the parameters of the elements of the indicated four terminal networks is used. For the investigated models the expressions were obtained for the sensitivity functions in operator form by means of which the dynamic simulation errors in the given time interval can be estimated directly on the analog computer.

USSR UDC 536.522.621.386.8(088.8)

TEMPERATURE MEASUREMENT PROCEDURE

Moscow [IN-T PROBL. MATERIALOVED. AN USSR] Avt. Sb. SSSR, KL. G 01 k 11/14, No 493660, ZAYAVL. 2.08,74, No 2049201, OPUBL. 16.02.76 [Institute of Problems of Materials Sciences of the Ukrainian SSR Academy of Sciences] USSR Author's Certificate No 493600, Claimed 2 Aug 74, No 2049201, Published 16 Feb 76] in Russian

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.811]

SAVVAKIN, G. I.

[Text] In the proposed procedure the powdered refractory material (with high density of structural defects) is treated in advance by a 40-200 kbar shock wave; in the measured temperature range in this material the phase transformations are absence; they are introduced into the measurement zone and then the width of the x-ray diffraction line is measured for the powder removed from the measurement zone by which the temperature is established, comparing the measured line width with the standard.

USSR UDC 531.73.001.24:778.38

METHOD OF DETERMINING THE VOLUME OF BODIES BY THE HOLOGRAPHIC IMAGE MEASUREMENT DATA

Moscow V. SB. GOLOGR. METODY I APMARATURA, LRIMENYAYEMAYA V VIZ. ISSLED. [Collection of Works Holographic Methods and Equipment Used in Physical Research] in Russian 1976 pp 41-43

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZNERITEL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.337]

PAVLYGIN, G. N., and ROSS, S. V.

[Text] The known method of calculating the volume with respect to the data from measuring the cross sectional area of a holographic image cannot be implemented in practice as a result of the complexity of the shape, a large number of objects, and so on. For certain types of moving objects the method of recalculation of the maximum (middle) cross section to the volume using the statistical recalculation algorithm is proposed. The procedure permits determination of the volume of the objects with an error of 0.6 percent under the condition that the number of objects is more than 300. Tables 2.

USSR UDC 620.179.15

STUDY OF THE SENSITIVITY OF THE CONTROL OF THE MASS THICKNESS OF PRODUCTS BY ELECTRONS WITH AN ENERGY TO 30 MEGAELECTRONVOLTS

Tomsk in Russian 1976, 7 pages, illustrations, 9 references (Manuscript deposited at the TsNIITEIpriborostroyeniya Institute 21 May 76, No 519)

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 10, 1976, Abstract No 10.32.314]

ZYKOV, V. M., and YUNDA, N. T., Tomsk Polytechnical Institute

[Text] A description is presented of the results of the theoretical and experimental study of the sensitivity of the mass thickness control of uniform and layered products by electrons with an energy to 30 megaelectronvolts. For the theoretical estimate of the sensitivity of the control by the Monte Carlo method with respect to the known program, calculations were made of the energy and numerical transmission coefficient of the electrons through the uniform and nonuniform with respect to chemical composition (layered) barriers made of materials with atomic numbers from 6 to 29. The

results of the calculations and the experimentation which agree with each other are represented in the form of emperical expressions permitting estimation of the sensitivity of the control of the mass thickness of any uniform or layered products. The relative sensitivity of the mass thickness control of the products obtained on the mockup radiometric device is 0.2 percent for linear control rate to 60 m/hr.

USSR UDC 541.24:532.5

COMPUTATION OF THE AVERAGE COEFFICIENTS OF ABSORPTION OF AIR FOR TEMPERATURES FROM 10,000°K TO 20,000°K AND PRESSURES FROM 0.1 ATM TO 100 ATM

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 10-12

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B771 by N. M. Kuznetsov]

ZAMURAYEV, V. P. and MASLENNIKOVA, I. I.

[Text] The average coefficient of air absorption is computed by the method of approximate replacement of the real spectrum by the graduated one. The entire range of frequencies making a basic contribution to the radiation flux is divided into nine intervals, and in each interval the spectral coefficient of absorption is replaced by the average geometric one from the Planck and Rossland coefficients of absorption computed for the given interval. The authors take into account the molecular bands of absorption of O_2, N_2, NO and N_2^+, the photoionization of atoms and molecules, the photodissociation of molecules, photoseparation of the electron from the negative ions, retardation processes and bound-bound transitions in atoms and ions. The authors used known data on the cross sections of all photo-processes taken into account. The contours of the lines were assumed to be dispersion ones. They give an estimate of the error of the method for a total radiation flux and for spectral intervals.

USSR UDC 536.248.2.001.5

DETERMINATION OF THE BOUNDARY BETWEEN ANNULAR AND DISPERSE STRUCTURES OF A TWO-PHASE FLUX

Minsk TEPLOMASSOOBMEN - V. MATERIALY V VSESOYUZNOY KONFERENTSII PO TEPLOMASSOOBMENU [Heat and Mass Exchange - V. Materials From the Fifth All-Union Conference on Heat and Mass Exchange, Collection of Works] in Russian Vol 3, Part 1, 1976 pp 239-245

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10G84]

FEL'DBERG, L. A., DOBKES, A. L., ZYSIN, L. V., and SAZHENIYA, A. G.

[Text] The authors describe three optical methods for investigating the mechanism of boiling of underheated water in plane-parallel vertical channels. The quantitative shadow method gives satisfactory results for large vapor contents. Error in determining the temperature does not exceed 15%. The holographic method permitted registering bubbles with a minimum size of five micrometers. The relative error for bubbles with $d = 10^{-2}$ mm is 20%, for bubbles with $d = 4 \cdot 10^{-2}$ mm it is 5%. For study of the dynamics of the centers of vapor formation the authors used the method of high-speed cinematography. Figures 5; References 3.

USSR UDC 535.232.65:536.2.089.68

WORKING STANDARD OF THE TEMPERATURE UNIT ACCORDING TO THE SCALE OF INTEGRAL RADIATION FOR THE RANGE OF 300-600°K

TRUDY METROLOGICHESKIKH INSTITUTOV SSSR. VNII METROLOGII [Works of the Metrological Institutes of the USSR. All-Union Scientific Research Institute of Metrology] in Russian No 183(243), 1975 pp 39-45

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1975 Abstract No 9.32.679]

SHPIGEL'MAN, YE. S., IVENSKIY, S. N., FINKEL'SHTEYN, V. YE., and SHISHKINA, I. I.

[Text] The authors describe the standard of radiation temperature developed at the Khar'kov State Scientific Institute of Measures and Measuring Instruments for calibration and attestation of sample telescopes of pyrometers of total radiation of the higher discharge with an indicator of sighting of 1/16 and less in the temperature range of 300-600°K. They give the results of investigations which prove that the standard may be recommended for calibrating wide-angle low-temperature telescopes of pyrometers of total radiation. Figures 4; References 6.

USSR UDC 533.915.082.5.089.68:543.422.6

BASIC QUESTIONS OF CREATING STANDARD PLASMA SOURCES OF RADIATION FOR THE REGION OF VACUUM ULTRAVIOLET (VUV)

TRUDY METROLOGICHESKIKH INSTITUTOV SSSR. VNII METROLOGII [Works of the Metrological Institutes of the USSR. All-Union Scientific Research Institute of Metrology] in Russian No 183(243), 1975 pp 5-15

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.678]

KANDYBA, V. V., LIBKIND, L. D., PUSHKAREV, G. P., and RISTO, V. A.

[Text] Growing interest in investigations in the vacuum ultraviolet (VUV) region of the spectrum of radiation of different objects has made necessary a metrological guarantee of the methods and means of measurements for this region. The most important problem of such a guarantee is the uniformity of all measurements by creating standard sources of VUV radiation which may be used either as a measure of comparison in the experiment itself or in an individual experiment for calibration of the measuring apparatus. This problem at the present time has not been solved at that level which is necessary for making confident and precise measurements, and the lack of a standard measuring apparatus makes it difficult to compare the results of various measurements. In this respect the creation of a State high-temperature standard for the VUV region of the spectrum is a necessary metrological condition and allows not only increasing the measurement accuracy but also ensuring uniformity of the measurements in the Nation. The authors examine ways of creating a State standard of high temperatures for the region of the vacuum ultraviolet, determining the requirements for it and discussing the scientific-technical bases of the standard. Table 1; References 10.

USSR UDC 533.915.536.5.081.3(08)

ON THE RELIABILITY OF USING HYDROGEN SPECTRAL LINES FOR REPRODUCTION OF THE KELVIN TEMPERATURE UNIT IN THE RANGE OF 11,000-16,000°K

TRUDY METROLOGICHESKIKH INSTITUTOV SSSR. VNII METROLOGII [Works of the Metrological Institute of the USSR, All-Union Scientific Research Institute of Metrology] in Russian No 183(243), 1975 pp 91-100

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.675]

ROZHKOV, V. V.

[Text] The author examines the temperature dependence of the spectral intensity of radiation in the center of the lines Hα (λ = 656,279 nm)

and Hγ (λ = 434,047 nm) in the temperature range of 10,000-20,000°K. He determines the conditions for which the spectral intensity of radiation in the center of the line Hβ coincides with the spectral intensity of radiation of an absolutely black body at the same frequency and temperature, and the peak intensity of the line Hγ passes through the maximum. It is shown that the value of the temperature T_0, corresponding to this maximum, enters the region of saturation of the line H, which presents the fundamental possibility of using T_0 as the reference point. Figure 1; Table 1; References 3.

USSR UDC 532.5:532.135

ON THE DETERMINATION OF THE RADIUS OF SPREAD OF CEMENTATION SUSPENSIONS IN FISSURED MEDIA

TRUDY NII STROITELSTVA UGOL'NYKH I GORNORUDNYKH PREDPRIYATIY "KUZ-NIISHAKHTOSTROY" [Works of the Scientific Research Institute of Construction of Coal and Mining Enterprises "KuzNIIshakhtostroy"] in Russian No 13, 1975 pp 40-47

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B832 by the authors]

DUDA, YE. G., and KHYAMYALYAYNEN, V. A.

[Text] The authors give the method of computing the limiting radii of the spread of unstable cementation suspensions during the cementation of a fissured medium from a single well with constant flow rate. They investigated the change in degree of filtration of the liquid phase in the crack along the length of the stream. In the form of a nomogram they present the dependence of the limiting radii of cementation on the gradients of pressures and filtration characteristics of the medium to be cemented. References 6.

USSR UDC 621.643.002(204.1)/693.5+001.2

RIGIDITY OF SPLIT REINFORCED CONCRETE COVERING OF UNDERWATER PIPE CROSSINGS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 9, Sep 76 pp 16-17

GOL'TSOV, N. KH., ZAYPOL'D, V. V., and TSVETKOVA, G. M., Experimental Design Office for Reinforced Concrete, USSR Ministry for the Construction of Enterprises in the Petroleum and Gas Industry

[Abstract] Girthwise cuts made in reinforced concrete covering of pipes laid along river crossings to prevent girthwise and longitudinal cracks were found to reduce pipe rigidity. Cut spacings equal to three pipe diameters can reduce pipe rigidity by five-sixths. Cracks can be prevented in pipes sagging under the combined weight of concrete covering and pipe proper by making the concrete covering split lengthwise.

USSR UDC 533.6.011.8

CHEMICAL HF LASER OPERATING AT HIGH PRESSURE OF THE ACTIVE MEDIUM

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 64-65

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B269 by O. K. Rozanov]

KHAPOV, YU. I.

[Text] The author reports on the preliminary results of investigating the chemical laser on a mixture of H_2+SF_6 with a density of the inserted energy up to 0.1 J/cm^3, which significantly exceeds the amount of the inserted specific energy existing in the experiments of other investigators. Initiation of the chemical reaction was done by an electronic beam across the optical axis. The energy of the electrons did not exceed 150 keV with a beam energy up to 16 J. The experiments were conducted in a pressure range from 0.1 to 2 technical atmospheres with H_2:SF_6 ratios from 1:30 to 1:2. The laser operated with one mirror. The author obtained a series of dependences of the energy of emission on the pressure of the active medium with H_2:SF_6 ratios equal to 1:23, 1:8 and 1:2. It was shown that with increase in pressure the energy of emission grows, reaches a maximum value, and then drops. The growth in energy of emission is caused by the increase in the inserted energy per unit of volume, and also by the increase in efficiency. With further increase in pressure, the processes of collision deactivation begin to appear more strongly, which leads to a decrease in the energy emitted. It was established that the maximum energy of emission was observed with H_2SF_6 ratios from 1:6 to 1:15. With a smaller amount of H_2 the energy of the laser decreases because of its lack (the probability of interaction of the F with the H_2 is decreased); with high partial pressure the rate of the collision deactivation is increased, which also leads to a decrease in output energy. It was found that with increase in the energy inserted per unit of volume of the active medium, the efficiency of the laser grows, the amount of which in these experiments reached 11%.

USSR UDC 62.551.4

THE SYNTHESIS OF AN OPTIMAL THREE-POSITION REGULATOR FOR A NONLINEAR OBJECT

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 10, 1976 pp 32-36 manuscript received 20 Feb 76

AVRAMOV, V. P. and ALEKSANDROV, YE. YE., Khar'kovskiy Polytechnic Institute imeni V. I. Lenin

[Abstract] The mathematical synthesis of the optimum three-position regulator for an object whose movement is described by a series of nonlinear

differential equations is considered. Dynamic programming leads to a functional of Bellman's equation which is approximated by an exponential series. The resulting system of equations is solved using the Repin-Tret'yakov method. An example of the use of the method is given, which results in a parabolic solution via the method of least squares. Figures 1; References 4 Russian.

USSR UDC 535.421

ON THE QUESTION OF OBTAINING ECHELETTES WITH HIGH COEFFICIENTS OF REFLECTION

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 8, 1976 pp 87-91 manuscript received 26 Nov 75

KOSSOVA, N. F. and KATSNEL'SON, P. Z., Leningrad Institute of Exact Mechanics and Optics

[Abstract] The reflection coefficients of four echelettes and their replicas with different constants and angles of luminosity but the same angle between the lines were compared to that of an aluminized mirror standard at different wavelengths of polarized light. The lower the ratio between the wavelength of maximum concentration and the grating constant used the higher the reflection coefficient at maximum found for both parallel and perpendicular vectors. When the ratio was greater than one the region of maximum concentration was sharply narrowed, and dispersion in the nonworking forms was reduced. Comparison of two gratings with angles between line edges of 107° and 93° showed that the smaller angle increases by 1.4 times the portion of the spectrum where the reflection coefficient exceeds 40% and that where the coefficient exceed 60% by three times. The coefficients of reflection for parallel vectors agree with theoretical calculations only from 3000 to 2000 cm^{-1}, while those for perpendicular vectors are 10% lower in this area. Replicas had 5-10% greater coefficients than the original echelettes. As a result of the above it is recommended that the use of replica gratings with coefficients of reflection from 70 to 75%, angles between line edges of 90-93% and a ratio between the wavelength of maximum concentration and the grating constant of 0.9 will give resoltuion of better than 0.5 cm^{-1} with only two gratings for the IKS-16 and IKS-24 IR spectrophotometers. Figures 3; Tables 1; References 4: 3 Russian, 1 Western.

USSR

UDC 77.01:53

MATRIX MODEL OF AN INVARIANT NONLINEAR PHOTOGRAPHIC SYSTEM

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 21, No 6, Nov/Dec 76 pp 419-425 manuscript received 17 Jun 75

TITKOV, B. V., SHABANOV, A. I., SHABAKOV, YE. I., and YANTUSH, D. A., Laboratory of Aeromethods

[Russian abstract provided by the source]

[Text] A convolution integral does not permit description of an actual photographic system that is characterized by appreciable nonlinearity and dependence of point scattering functions on the coordinates of the field of view. This paper presents a method of mathematical description that permits representation of a photographic system to a high degree of precision by means of equivalent matrices having elements that may depend on the coordinates of the field of view, the point scattering function and so forth. Nonlinearity is described by matrix functions having polynomial elements with coefficients predetermined on the basis of experimental studies. The proposed model is convenient for computer simulation of photographic systems. Figures 3; References 4 Russian.

USSR UDC 539.3

SOME GENERAL CONCEPTS OF SOLUTIONS TO DYNAMIC EQUATIONS IN THE THEORY OF ELASTICITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 227, No 1, 1976 pp 71-74

ZIL'BERGLEY, A. S., and ZLATINA, I. N., Engineering Physics Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Representing solutions to Lame's equations in the Pankovich-Neyber form is vital in solving static problems in the theory of elasticity. Other representations of solutions to equations of steady elastic oscillations are sought: in some sense, they are a generalization of the static Pankovich-Neyber representation.

USSR UDC 539.3

ON THE INFLUENCE OF A RIVETED STRINGER ON STRESS IN A SHEET WITH A CRACK

Kiev PROCHNOST', NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH KONSTRUKTSIY [Strength, Reliability and Lifetime of Aviation Structures, Collection of Works] in Russian No 1, 1975 pp 29-36

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V208 by v. M. Tolkachev]

PAVELKO, V. P.

[Text] The author examines a sheet with a semi-infinite crack. At a slight distance from the top of the crack an infinite stringer is riveted, the axis of which is perpendicular to the edges of the crack. Friction between the stringers and the plate are not taken into account, therefore the influence on the coefficient of stress concentration at the top of the crack will be exerted only by the forces applied to the rivets. To determine the stresses in the rivets the author obtains an infinite system of algebraic equations; in the computations the author uses a truncated system. Computation examples are given.

USSR UDC 539.214;539.374

ON THE POWER FUNCTION AND RELATIONSHIPS BETWEEN STRESSES AND STRAINS

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 187, 1975 pp 81-89

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V525 by the authors]

AKHMEROV, A. F., and LYSOV, M. I.

[Text] The authors suggest a power equation of general type which reflects with sufficient accuracy the regularity of material strengthening. It may be used as the basic physical equation of the theory of plasticity for linear biapproximation or piecewise approximation by simpler equations. The use of its specific cases permits with sufficient accuracy solving a series of technological problems of the theory of plasticity in closed form. References 5.

USSR UDC 534.26

DYNAMIC INTERACTION OF SYSTEMS OF CRACKS UNDER CONDITIONS OF ANTIPLANE STRAIN

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 157-168 manuscript received 17 Jul 75

MARTYNYUK, P. A., and POLYAK, E. G. Novosibirsk

[Abstract] Earlier studies have been devoted to problems of a dynamic effect on an isolated crack in an infinite elastic body. This paper attempts to arrive at solutions to dynamics problems involving a more complex geometry, explaining the influence of adjacent cracks, systems of cracks, and the boundaries of the body. It was possible to obtain precise solutions to boundary-value problems when the length of the cracks is much larger than either the distance between them or the distance to the boundary of a half-space, for conditions of antiplane strain. The methods of solution employed can be carried over to the case of plane strain without special difficulty. Consideration is given to a system of parallel cracks by analyzing an isotropic elastic space containing an infinite number of cracks of two different lengths, parallel to one another and at a given distance from one another, under conditions of antiplane strain. A second dynamic loading problem is devoted to an isolated crack parallel to the boundary of a half-space. Two variants

of boundary conditions are studied: The boundaries of a layer and half-space are either strictly closed or are free of stresses. These problems are solved by finding solutions to Fredholm equations of the second type, through which stress intensity factors are expressed. Numerical inversion of the Laplace transform is used to plot curves expressing the relationship between stress intensity factors with discontinuity at the forward edges of cracks and time, and curves for the relationship between stress intensity factors and the distance-vs.-length ratio of corresponding static problems obtained at the boundary when time approaches infinity. Precise solutions to boundary-value problems when initial length is far greater than distance are obtained by the Wiener-Hopf method. Figures 6; References 7: 4 Russian, 3 Western.

USSR UDC 539.3:534.1

POST-CRITICAL STAGE OF SHELLS OF REVOLUTION OF NEGATIVE GAUSSIAN CURVATURE UNDER COMPRESSION

TRUDY TALLINSKOGO POLITEKHNICHESKOGO INSTITUTA [Transactions of Tallin Polytechnical Institute] in Russian No 293, 1976 pp 121-129

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11V279 by the author]

LIYVA, T. V.

[Text] Longitudinally compressed shells of revolution with negative gaussian curvature lose stability at high wave numbers m in the circumferential direction. It is proved that when $m \geqslant 1$ the initial post-critical stage of these shells is always stable in the geometrically nonlinear approximation. This stage is determined by a relatively simple criterion that is also derived in this paper.

The behavior of the part of a torus where gaussian curvature is negative is studied in a numerical example. It is shown that the post-critical behavior of a torus is always stable with variation in the geometry of such a shall over a fairly wide range. References 5.

USSR UDC 539.375

USING DIMENSIONAL ANALYSIS TO DESCRIBE THE PRINCIPLES THAT GOVERN BRITTLE FRACTURE

Kuybyshev TEZISY DOKLADOV VOS'MOY VSESOYUZNOY KONFERENTSII PO FIZIKI PROCHNOSTI I PLASTICHNOSTI METALLOV I SPLAVOV [Abstracts of Papers of the Eighth All-Union Conference on Physics of the Strength and Ductility of Metals and Alloys] in Russian 1976 pp 244-245

[From REFERATIVNYY ZHURNAL MEKHANIKA No 11, 1976 Abstract No 11V502 by V. Ye. Mozharov]

IVANOVA, V. S., YERMISHKIN, V. A., and PLASTININ, V. M.

[Text] For the case where there is no known analytical description of the fracture process, but the factors that influence the course of the process are known, it is proposed that dimensional analysis be used to establish the relation between these factors.

Assuming that σ_f depends on such parameters as crack length l, the radius r at the tip of the crack, the opening δ between the edges of the crack, surface energy S, elastic modulus E, loading rate h, crack velocity V_T, material density ρ, heat capacity C, thermal conductivity λ and testing temperature T, the authors propose the expression

$$\sigma_f = \text{const}\left(\frac{SE}{l}\right)^{1/2}\left(\frac{r}{\delta}\right)^{\varkappa}\left(\frac{V_T}{h}\right) f(\psi)\exp\left[\frac{Q}{RT}\right]$$

It is shown that this expression is a kind of generalized equation for σ_f that shows the relation between the microparameters and macroparameters of the brittle fracture process as defined by the Griffiths formula, Orovan's formula, the criterion of critical crack width and the expression for the coefficient of stress intensity K_{Ic}. The orientation function $f(\psi)$ that appears in the formula accounts for the relative placement of the "crack plane" and the crystallographic planes surrounding the tip of the crack along which dislocations can move.

USSR UDC 539.214;539.374

METHOD OF SHALLOW GROOVES FOR DETERMINING PERMANENT STRESSES

Kuybyshev TRUDY KUYBYSHEVSKOGO AVIATSIONNOGO INSTITUTA [Works of Kuybyshev Aviation Institute] in Russian No 77, 1975 pp 44-52

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V558 by the author]

GRIGOR'YEV, I. V.

[Text] The author suggests a method of grooves for determining the permanent stresses in a thin surface layer of a part. When two grooves are made, the deformation of the surface between them is measured and is used for computing the permanent stresses. The connection between the measured deformations and permanent stresses is established by the methods of the mathematical theory of elasticity. The depth of the grooves, up to which the obtained formulas are applicable, is established experimentally.

USSR UDC 539.31:534.1

INFLUENCE OF INITIAL IMPERFECTIONS IN THE SHAPE OF A MIDDLE SURFACE ON THE STABILITY OF SHELLS BEYOND THE ELASTIC LIMITS

Tomsk MATERIALY 5-OY NAUCHNOY KONFERENTSII PO MATEMATIKE I MEKHANIKE. TOMSK UNIVERSITET [Materials of the Fifth Scientific Conference on Mathematics and Mechanics. Tomsk University, Collection of Works] in Russian 1975 p 130

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V423 from the article]

KUDINOV, A. N.

[Text] On the basis of the approximate approach the author gives the solution to problems of inelastic stability of shells loaded with uniform internal pressure or compressive stresses by allowing for several forms of the initial bending. The subcritical stress-strain state is determined from a system of linearized equations of momentless theory. As the original equations the author uses the equations of a perturbed state by allowing for the initial bends. The results of the solutions are presented in the form of nonlinear functionals relative to the loading parameter, the minimization of which over the parameters of the wave formation is done numerically on a computer. The author investigates the influence of the

amplitude of the initial bend, similar to the shape of the buckling of ideal shells, on the size of the critical loads of axial compression and internal pressure. To determine the critical compressive stress of cylindrical and truncated conical shells the author obtains a generalized formula: $\sigma_i = \sigma_{i0}(1+6 \times 10^{-3} R/h)$, computations by which agree well with the data of the tests of shells in a broad range of variation of the parameters l/h and L/R. Here σ_{i0} is the critical value of the intensity of stresses for ideal shells.

USSR

UDC 539.31:534.1

NUMERICAL METHOD FOR SOLVING GEOMETRICALLY NONLINEAR AXISYMMETRIC PROBLEMS OF BUCKLING AND SUPERCRITICAL DEFORMATIONS OF ELASTOPLASTIC SHELLS OF ROTATION

Moscow CHISLENNYY METOD DLYA RESHENIYA GEOMETRICHESKO NELINEYNYKH OSESIMMETRICHNYKH ZADACH O VYPUCHIVANII I ZAKRITICHESKIKH DEFORMATSIYAKH UPRUGO-PLASTICHESKIKH OBOLOCHEK VRASHCHENIYA [Numerical Method for Solving Geometrically Nonlinear Axisymmetric Problems of Buckling and Supercritical Deformations of Elasto-Plastic Shells of Rotation] in Russian (Manuscript deposited in the All-Union Institute of Scientific and Technical Information, 16 February 1975, No 499-76 Dep), Moscow Aviation Institute Press, 1975 20 pp

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V421 by the authors]

BURAGO, N. G., and KUKUDZHANOV, V. N.

[Text] The authors describe a numerical solution to axisymmetric buckling of elasto-plastic spherical shells flexibly fastened along the edge and loaded with internal uniform pressure. They use Reisner's modified equations of nonsloping shells (see GRIGOLYUK, E. I., MAMAY, V. I., and FROLOV, A. N., Izvestiya AN SSSR, Mekhanika Tverdogo Tela, No 5, 1972 pp 154-165, REFERATIVNYY ZHURNAL, MEKHANIKA No 3, 1973 Abstract No 3V293) and the theory of plastic flow. References 10.

USSR UDC 629.78.015.4

STABILITY CALCULATIONS OF RODS USING THE METHOD OF REDUCED LOADS

Ufimsk TR. UFIM. AVIATS. IN-T in Russian 1975 vyp 98 pp 124-134

Moscow REF ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.121

MULLAGULOV, M. KH.

[Text] A method of reduced loads has been developed for stability calculation of an elastic deforming straight rod under the influence of several concentrated and arbitrary distributed loads. Using the graph of reduction of the critical force, this system of loads is replaced by one reduced load applied to some other rod. To illustrate the method, several examples are given and a comparative analysis with results of calculations using existing methods is presented. Illustrations 3; References 5.

USSR UDC 629.78.023.015.4

CALCULATION OF A SPHERICAL ENVELOPE LOADED WITH TORQUE THROUGH AN ECCENTRICALLY SITUATED RIGID DISC

Kuybyshev TR. KUYBYSHEV. AVIATS. IN-T in Russian 1975 vyp. 77 pp 23-26

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.122

GORBATENKO, V. V.

[Text] Numerical results of research of the stressed state of a hemispherical envelope, rigidly fastened along its lower edge and loaded with torque through an eccentrically situated rigid circular disc are presented. Results of calculation are presented as graphs of the expansion of stresses along the envelope as a function of the angle of displacement of the center of the disc from the size of the envelope. Illustrations 5; References 2.

USSR UDC 539.379

ON REFINING THE COMPUTATION OF CRITICAL ROTATION VELOCITIES OF GAS-TURBINE ENGINE ROTORS

Kiev NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH GAZOTURBINNYKH DVIGATELYEY [Reliability and Lifetime of Aviation Gas-Turbine Engines, Collection of Works] in Russian No 2, 1975 pp 77-80

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.27 by resume]

KOLOBANOV, V. YU., and MILOV, A. B.

[Text] The authors give a procedure for determining elastic movements in swing supports of aviation engines which allows taking into account the influence of pliability (rigidity) of bearing supports in computing the critical rotation velocities of gas-turbine engine rotors. Figure 1; References 3.

USSR UDC 629.7.036.3

OPTIMAL PLANNING OF DISKS FOR TURBOMACHINERY

Kiev NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH GAZOTURBINNYKH DVIGATELYEY [Reliability and Lifetime of Aviation Gas-Turbine Engines, Collection of Works] in Russian No 2, 1975 pp 67-70

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.29 resume]

BORISKIN, O. F., and KAZ'MIN, V. V.

[Text] The authors solve the problem of finding the edge of a disk which makes bending oscillations with an arbitrary number of nodal diameters and circumferences in which the dynamic strength of the various points is the same. In finding the dynamic stresses in a disk of variable thickness, the authors use the method of initial parameters in matrix form by replacing the real edge with a graduated one. They give a numerical example of using a digital computer to find the optimal edge of a disk, oscillating with two nodal diameters and without nodal circumferences. Figure 1; References 3.

USSR UDC 621.438-253.5:536.245

INVESTIGATION OF THE TEMPERATURE STATE AND EFFECTIVENESS OF COOLING TURBINE BLADES

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 191, 1975 pp 39-43

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.30 resume]

LOKAY, V. I., GUNCHENKO, E. I., DRYGIN, V. V., LIMANSKIY, A. S., and SHCHUKIN, A. V.

[Text] The authors describe the results of an experimental and computational investigation of the internal convective and combined (with perforation of the inlet and outlet edges) cooling of the blades of a gas turbine. They give the experimental determination of temperature in the average cross section of the blade for convective and combined cooling and compare it with the computed one. They compare the experimental values of cooling effectiveness and the dimensionless temperature of the inlet and outlet edges as a function of relative air flow rate for both types of cooling. Figures 4; References.

USSR UDC 629.7.03:621.438

TEMPERATURE FIELD OF TURBINE BLADES COOLED UNDER NONSTATIONARY CONDITIONS

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 191, 1975 pp 28-35

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.33 resume]

LOKAY, V. I., ZHUYKOV, V. V., ZAKIROV, M. U., and TRUSHIN, V. A.

[Text] The authors discuss an explicit difference method for computing nonstationary temperature fields in the cross section of turbine blades being cooled under variable boundary conditions and by allowing for the dependence of the coefficient of thermal conductivity on temperature. They describe the features of assigning the original data in the computer computation program. The authors cite the results of computing the temperatures in the blade using two means of assigning the boundary conditions. Figures 4; References 3.

USSR UDC 536.24

A GRADIENT METHOD OF INVESTIGATING HEAT YIELD FROM ROTATING DISKS

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 194, 1975 pp 13-18

[From REFERATIVNYY ZHURNAL, AVIATIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.3434 resume]

OLIMPIYEV, V. V., SHCHUKIN, V. K., and SHAGIMARDANOV, G. SH.

[Text] The authors examine the theoretical bases and technical realization of a gradient method of investigating local coefficients of heat yield on the surfaces of rotating disks. Use of this method is demonstrated on a device for investigating heat yield inside a closed rotating volume of liquid with one-sided underheating. They give examples of the dependence of the local coefficient of heat yield on radius and time. Figures 3; References 7.

USSR UDC 629.036.3-226:536

ON A DETERMINATION OF THE COEFFICIENT OF HEAT YIELD ON THE TURBINE BLADES OF GAS-TURBINE ENGINES IN NONSTATIONARY OPERATING MODES

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of Ufa Aviation Institute] in Russian No 96, 1975 pp 80-85

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.35 resume]

PANTELEYEV, A. A., and TRUSHIN, V. A.

[Text] The authors suggest a procedure for experimentally determining local coefficients of heat yield during the flow around the edge of a blade by a nonstationary nonisothermal stream of gas. The suggested detector for determining $\alpha_{nonstat}$ permits determination of $\alpha_{nonstat}$ directly without determining the nonstationary thermal flux on the wall of the blade. The procedure allows taking into account the dependence of the thermophysical properties of the detector material on the temperature. Figures 2; References 7.

USSR UDC 621.438:536.24

SEVERAL RESULTS OF AN EXPERIMENTAL INVESTIGATION OF HEAT YIELD IN THE FLOW RATE OF A TURBINE

Kazan' TRUDY KAZAN'SKOGO AVIATSIONNOGO INSTITUTA [Works of Kazan' Aviation Institute] in Russian No 191, 1975 pp 20-23

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.37]

BODUNOV, M. N., ZAKIROV, M. U., and LOKAY, V. I.

[Text] The authors discuss the results of experiments on investigating the average (by profile contour) coefficient of heat yield and heat yield on the end surface (in the radial gap) of the working blades which had no binding bands. The tests were conducted on an experimental air turbine. For investigation of heat yield the authors used the method of a regular thermal regime. Comparison of the test results for the average (by profile contour) coefficient of heat yield under conditions of rotation with the experimental data on the same blades under static conditions permitted obtaining numerical values of the coefficient of heat yield intensification. Heat yield on the end surface of working blades was compared with the heat yield of a flat plate in a turbulent streamlining regime. The intensity of heat yield on the end surface of the working blades was found to be higher than on the plate. Figures 4; References 6.

USSR UDC 629.7.035.3-752

NONLINEAR SPATIAL VIBRATIONS OF A TURBOPROP ENGINE ON AN ELASTIC PYLON

Ufa TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Works of Ufa Aviation Institute] in Russian No 98, 1975 pp 66-76

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.75 resume]

ASKAROV, M. M.

[Text] For the turbojet engine examined as a solid body with six degrees of freedom, the author obtains differential equations of spatial vibrations by allowing for nonlinear terms up to the second order of magnitude relative to the coordinates and their derivatives. The author investigates the reasons for the onset of combination resonance and the influence of the geometric, mass, and inertial parameters on the stability of the systems. Figures 5; References 5.

USSR UDC 621.165.001.2:533.6.011

CONSTRUCTION OF THREE-PARAMETRIC PROFILE GRIDS OF WORKING BLADES OF THE LAST STAGES OF TURBOMACHINERY

PROBLEMY MASHINOSTROYENIYA. RESPUBLIKANSKIY MEZHVEDOMSTVENNIY SBORNIK [Problems of Machine Construction. Republic Interdepartmental Collection] in Russian No 2, 1976 pp 113-118

[From REFERATIVNYY ZHURNAL, TUBOSTROYENIYE No 8, 1976 Abstract No 8.49.11]

POZNAKHIREZ, V. F., TARELIN, A. A., and ANTIPTSEV, YU. P.

[Text] The authors discuss an analytical method of constructing profile grids with respect to the blades of the last stages of turbomachinery with the aid of the so-called equation of a "deformed" lemniscate: $\rho = \sqrt{a\ 2[2\cos^2(\varphi + \gamma) - \lambda]}$. The procedure permits obtaining highly effective profiles in a wide range of variation in the original data and gives the possibility of using methods of optimizing the profiles which are simple and convenient in the practical sense. Figures 3; References 3.

USSR UDC 621.165:533.6

INFLUENCE OF THE DEGREE OF TURBULENCE ON THE CHARACTERISTICS OF TURBINE STATOR GUIDE VANES

Cheboksary PROMYSHLENNAYA TEPLOTEKHNIKA I GIDRAVLIKA [Industrial Heat Technology and Hydraulics, Collection of Works] in Russian No 1, 1975 pp 35-43

[From REFERATIVNYY ZHURNAL, TURBOSTROYENIYE No 8, 1976 Abstract No 8.49.17]

LAZAREV, L. YA., and POLNIKOVA, T. V.

[Text] The authors give experimental data and analysis of the experiments on investigating the influence of turbulence on the energy characteristics of the cascade TS-2A (S90/5A). The investigations were conducted on a steam wind tunnel in a wide range of variation in the M and Re number region. Figures 4; References 5.

USSR UDC 533.697

TESTING HYPERSONIC AIR INTAKES AT M = 2 - 6

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 234-236

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1146 by V. I. Bogomazov]

GILYAZETDINOV, B. N., and ZATOLOKA, V. V.

[Text] The authors investigated a hypersonic air intake of external compression with a computed number $M_r = 8$ when $M_n = 2 - 6$. They give the experimental values of the coefficient of flow rate as a function of the angle of glide and attack. The results of the test are compared with the computation. The parameters of the stream in the control cross section of the model (neck or input to the combustion chamber) were determined proceeding from the amount of static pressure in the neck and at the output from the measuring nozzle. The gas-dynamic parameters obtained in the tests permitted evaluating the thrust characteristics of the hypersonic jet engine with the investigated air intake.

USSR UDC 533.697

TESTS OF A HYPERSONIC CONVERGENT AIR INTAKE FOR M = 1.75 - 6

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 236-238

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1147 by N. A. Kolesnikova]

ZATOLOKA, V. V., and KISEL', G. A.

[Text] The authors give the results of an experimental investigation of the model of a hypersonic convergent air intake in a T-313 wind tunnel with Mach numbers of the incoming stream of $M_i = 1.75 - 6$ (less than the computed) at angles of attack of $\alpha = 3° - 12°$. They present the graphic dependences of the coefficient of flow rate $f = F_u/F_{nr0}$ (F_u is the area of the cross section of the jet of an unperturbed stream, encompassed by the air intake, F_{nr0} is the characteristic area of the air intake) on the Mach number M_i for an angle of attack of $\alpha = 0°$. An analysis is given of the shadow photographs of streamlining of the model, obtained at M_i = 1.7 and 6 for $\alpha = 0°$. The values of f and ν_g for the convergent air

intake are compared with the analogous values for a flat air intake. It was established that at numbers M_i = 1.75 and 2 the flat air intake has a higher coefficient of flow rate, for M_i = 3 the values of f practically coincide, and beginning with M_i = 4 the values of f of the convergent air intake exceed even more the values of f of the flat air intake. The coefficient of recovery ν_g for a flat air intake at Mach number of M_i = 2-4 is 20% higher on the average than for the convergent one, at M_i = 5 and 6 the values practically coincide. With the aid of the obtained gas-dynamic characteristics of the air intake the authors make an evaluation of the thrust characteristics of the possible hypersonic ramjet engine with a convergent air intake.

USSR UDC 533.6.011:51.55

SOME FORMULATION OF THREE-DIMENSIONAL OPTIMIZATION PROBLEMS IN HYPERSONIC AERODYNAMICS

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 69-77 manuscript received 26 Dec 75

DULOV, V. G., Krasnoyarsk

[Abstract] The focus here is on problems of optimizing the design of engine units for supersonic aircraft whose effective power balance is created by a uniflow ramjet engine running on liquid hydrogen and supersonic combustion. Elements of the engine unit such as the air intake and jet should make a determining contribution to the aerodynamics of the aircraft as a whole. Consideration is given to the following basic problem: Two arbitrary closed circuits are arranged in three-dimensional space; isobars of an unknown flow with given pressure values rest against these circuits. It is required to find the surface of the flow passing through both circuits and optimizing a certain integrated force characteristic of the unknown surface. Concrete definition of this problem consists in assigning the functional of the force effect. In making hypersonic calculations wide use is made of approximation and semi-empirical methods, which are oriented toward solving the problem of distribution of pressure over the surface of a streamlined body, the solution to which makes it possible to formulate the problem of optimizing the shape of this body with respect to its force characteristics. This optimization problem requires an algorithm for computing the pressure at points of the surface which is of sufficient simplicity, in order to achieve a nonformal formulation. The major approximation methods possess this simplicity but considerable difficulties are encountered in applying them to three-dimensional problems and in devising methods of making a reasonable estimate of accuracy. These methods are based on essentially different physical hypotheses, and it is therefore difficult to give them

a unified analytical representation based on any unifying feature, which would be especially useful in giving consideration to possible variants of combined methods. The purpose of this paper is to deal with the above optimization problem in light of the following considerations: The development of recommendations on applying these methods to three-dimensional problems; studying the feasibility of making a reasonable estimate of accuracy and making higher approximations; and finding a single analytical form of describing these methods. The latter is dealt with first. It is suggested that the methods be reduced to making an approximation for a unidimensional optimization problem. The gas dynamics basis underlying initial approximations is explained. Figures 2; References 4 (Russian).

USSR UDC 532.526

INFLUENCE OF HEAT TRANSFER ON THE CHARACTERISTICS OF A HYDRODYNAMIC LAMINAR BOUNDARY LAYER

ENERGETICHESKOYE MASHINOSTROYENIYE. RESPUBLIKANSKIY MEZHVEDOMSTVENNYY NAUCHNOTEKHNICHESKIY SBORNIK [Power-Generating Equipment. A Republic-Wide Inter-Agency Scientific and Technical Thematic Collection] in Russian No 22, 1976 pp 84-89

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B164 by the authors]

SLITENKO, A. F., and VOLOVEL'SKIY, I. L.

[Text] The paper examines the feasibility of calculating a laminar boundary layer in the case of flow around turbine blades with consideration of the influence of departure from isothermal conditions. Boundary layer parameters are calculated on the M-222 digital computer for flow around a T-4 blade. It is shown that departure from isothermal conditions must be taken into consideration when calculating the coordinate of the point of loss of stability of the laminar boundary layer because of the appreciable change in derivatives of the velocity profile with variation in the temperature factor under the conditions obtaining in actual high-temperature gas turbines.

USSR UDC 533.6.011

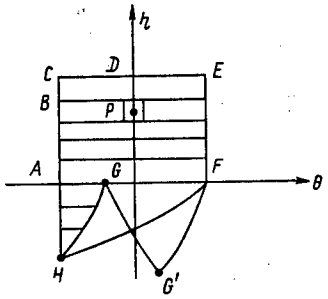
NUMERICAL SOLUTION OF A NUMBER OF FRANKL SHOCK-WAVE BOUNDARY VALUE PROBLEMS

TRUDY FRUNZENSKOGO POLITEKHNICHESKOGO INSTITUTA [Transactions of Frunze Polytechnical Institute] in Russian No 90, 1975 pp 93-95

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B217 by A. F. Kryuchin]

DUYSHEYEVA, T., OSELEDKO, R. A., and RYSKULOV, A.

[Text] An approximation solution is given for the problem of subsonic flow of an inviscid gas stream around a blade where a forward compression shock closes a localized supersonic zone. Two boundary value problems are solved: 1) the blade profile is known in the region of supersonic velocities; 2) the relation between velocity and angle of incidence of the oncoming flow is given over a part of the line of transition. In the plane of the hodograph, the stream function was determined from the equation $\psi_{\eta\eta}+\eta\psi_{\theta\theta} = 0$, assuming the following boundary conditions (see the drawing): $\psi=0$ on BCDEF; $\psi(\theta_1, \eta_1) = \psi(\theta_2, \eta_2)$ on HAB; $\partial\psi\ \partial\theta=0$ on HAB.



At point P corresponding to an infinitely remote point of the physical plane there is a singularity of the form $\psi=\rho^{-1/2}\sin\frac{t}{2}+0(\rho)^{1/2}$. In the case of the first boundary value problem $\psi=0$ on FG', and for the second problem $\psi=f(\theta)$ on FG. The problem was solved numerically by a finite-difference method; the calculations were done on the Minsk-22 computer. By solving the Goursat problem in region HGG' the authors were able to find the boundary HG' on which $\psi=0$. For the second boundary value problem the Cauchy problem was solved in the hyperbolic region.

USSR UDC 621.4/.6:533.6

INVESTIGATION OF ANNULAR CASCADES ON ADJUSTABLE GUIDE VANE ASSEMBLIES

TRUDY LENINGRADSKOGO KORABLESTROITEL'NOGO INSTITUTA [Transactions of Leningrad Shipbuilding Institute] in Russian No 101, 1975 pp 26-33

[From REFERATIVNYY ZHURNAL, MEKAHNIKA No 11, 1976 Abstract No 11B296 by the author]

ZHIDKOV, V. I.

[Text] Adjustable guide vane assemblies represent one of the effective methods of improving the economy of turbine stages per unit load and the maneuverability of gas turbine transport engines. Calculation of the characteristics of stages with adjustable guide vane assemblies requires knowledge of flow losses at different angles of flow discharge from the nozzles. Therefore experimental studies are done on annular cascades of guide vane assemblies with resultant determination of the variation in flow losses r_1, the angle of discharge α_1 and the flowrate factor μ with rotation of the guide vanes conforming to two twist laws: $\alpha_1 = \text{const}$ and $rC_u = \text{const}$. The angle of flow discharge from the nozzles under rated conditions on the middle radius was $\alpha_{1mid}=16°$ and 23° for vane rotation ranges of $\pm 5°$ and $\pm 9°$ respectively.

On the basis of analysis of experimental curves for the main parameters of annular cascades as a function of guide vane rotation, a computational formula is derived for determining the total flow losses ζ_Σ^{av} for different angles of turn of vanes with a type TS-2B profile. Some recommendations are also made on designing adjustable guide vane assemblies. References 10.

USSR UDC 532.5.071.4:533.697.3.001.24

LOSSES IN CHANNELS WITH ELEVATED EXTERNAL TURBULENCE

Moscow IZVESTIYA AKADEMII NAUK SSSR, ENERGETIKA I TRANSPORT in Russian No 5, 1976 pp 164-168 manuscript received 13 Feb 75, after correction 8 Apr 76

ZARYANKIN, A. YE., and SOLOV'YEVA, G. S., Moscow

[Abstract] An approximation method is suggested for allowing for the influence of external turbulence on the aerodynamic characteristics of convergent channels and diffusers, which must be taken into account in determining losses in turbine cascades and which must be considered a determining dimensionless parameter in experimentation. It is shown that even with a relatively low velocity coefficient losses with a high degree

of incoming flow turbulence differ substantially from losses with zero or low-level turbulence. Generalized areas of displacement and energy loss change with altered turbulence, whose increase leads to an increase in profile fullness and Reynolds potential and to an increase in the physical thickness of the boundary layer. Thus the problem of estimating losses in the channels boils down to determining the velocity coefficient which characterizes energy dissipation in the nucleus, and to calculating the integrated areas of the boundary layer which develops with elevated turbulence at this nucleus. The velocity coefficient is found easily from a formula derived in an earlier study. The relative area of energy loss and the relative area of displacement are estimated by approximation, utilizing features of the solution to Kármán's integral equation. The analytical approach taken to the formula for a smooth boundary layer with a comparatively low level of turbulence makes it possible to introduce into calculation the degree of turbulence of the external flow. Curves are given, showing the relationship between the integrated density of impulse loss in the outlet section of convergent channels and diffusers and the degree of turbulence. This approach can also be used for calculating the turbulent boundary layer in a flow of compressed gas. In addition, it is possible with a similar approach to correct the solution for taking moisture content into account in motion equations for a moist-vapor flow in turbine cascades. It is concluded that with considerable external flow turbulence it is necessary to take into account not only losses within the limits of the boundary layer, but also in the center of the channel. Utilizing Kármán's integral equation, an analytical formula has been found for calculating displacement thickness with elevated external flow turbulence. Figures 3; References 7: 4 Russian, 3 Western.

USSR UDC 533.652/.661.013

ON THE UTILIZATION OF A MODEL WITH FLOW FROM A CLOSED VOLUME FOR MODELING JETS FLOWING FROM A BODY

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 304-307

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1114 by B. I. Bakum]

VORONOV, G. M., and ZATOLOKA, V. V.

[Text] The authors suggest a method of modeling exhaust jets of aircraft engines with the aid of a gas discharge placed in the body of the test model. As the object of the investigation they examined a model of a supersonic airplane of Concord type or the TU-144 with four engines, made on a scale of 1:50 or 1:100 (in the latter case the length of the model is

600 mm, span of 260 mm, diameter of fuselage 30 mm). In the cavity inside the model they pump air at a pressure up to 500 technical atmospheres. During the experiment this air through the regulator which keeps a constant pressure at the outlet from the model or through a nonvariable choke opening leaves the receiver of the model, reproducing the jets of the engine. It was shown that with reproduction of typical trajectory values of the Mach flight numbers and on the cross section of the engine nozzle and ratio of the total pressure of jet retardation to the static pressure of the external stream the test time can be reduced to 0.3-4 seconds. This time exceeds by two or more orders of magnitude the time for establishment of the flow in the gas-dynamic circuit of the model and the time for setting up the strain gauge or electric pressure sensors. References 8.

USSR UDC 533.6.011.8

GAS DIFFUSION INTO A LOW-DENSITY SUPERSONIC JET

Novosibirsk DINAMIKA RAZREZHENNYKH GAZOV [Dynamics of Rarefied Gases, Collection of Papers] in Russian 1976 pp 71-78

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 11, 1976 Abstract No 11B331 by the authors]

SKVORODKO, P. A., and CHEKMAREV, S. F.

[Text] The problem of steady-state gas diffusion into a strongly underexpanded low-density jet from the surrounding flooded space is examined in the spherical source approximation. The analysis is based on the Chapman-Enskog hydrodynamic theory. The case where the escaping and diffusing gases are identifical in molecular properties is investigated. A numerical and approximate analytical solution is found for the problem, showing in particular the absence of microscopic motion of the ambient gas. The resultant solution is compared with a model kinetic solution and experimental data. It is demonstrated that a condition of practical importance is that a linear dimension of the vacuum chamber should be $L/r_* \ Re_*$, where r_* and Re_* are the radius and Reynolds number at the nozzle tip; this condition must be met for correct investigation of processes of diffusion in expanding gas streams on vacuum installations and comparison of the results of studies on different installations. References 5.

USSR UDC 620.179.16:534.232

A GENERATOR OF SHORT ACOUSTIC PULSES

Novosibirsk ISSLEDOVANIYA I RAZRABOTKI PO GIDROLOKATSII I AKUSTICHESKIM IZMERITEL'NYM SISTEMAM [Research and Development in Sonar and Acoustic Measurement Systems, Collection of Papers] in Russian 1976 pp 64-68

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.483]

MOROSOV, V. M., TSEKHANOVSKIY, S. A., and TSYMBALIST, V. A.

[Text] The paper describes a simple generator based on a TRIAC for exciting piezoelectric transducers. The device produces short acoustic pulses with duration of up to one period of the natural oscillations of the piezo-crystal, and rf recurrence rate (50-70 kHz) when operated into a radiator with capacitance of 20,000 pF. Figures 3; References 3.

USSR UDC 531.719.35:519.37:621.391

THE DELTIC-CORRELATOR FOR PROCESSING BINARY PSEUDORAMDOM-CODED SIGNALS IN ECHO SOUNDING

Novosibirsk ISSLEDOVANIYA I RAZRABOTKI PO GIDROLOKATSII I AKUSTICHESKIM IZMERITEL'NYM SISTEMAM [Research and Development in Sonar and Acoustic Measurement Systems, Collection of Papers] in Russian 1976 pp 15-23

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.475]

BENDT, G., and BARNIK, V.

[Text] The paper described the DELTIC-correlator, which can be used for processing binary pseudorandom-coded sonar signals. The improvement in signal-to-noise ratio is evaluated. The working principle and technical realization of the components of the correlator are described. The possibilities for using the correlator to locate various objects are examined. Figures 2; References 7.

USSR UDC 534.232

A PNEUMATIC ACOUSTICAL SIGNAL RADIATOR

OTKRYTIYA IZOBRETENIYA PROMYSHLENNYYE OBRAZTSY TOVARNYYE ZNAKI in Russian No 42, 1976 p 122 Item No 535591

LOBANOV, D. P., FONBERSHTEYN, YE. G., and EKOMASOV, S. P., Moscow Geological Prospecting Institute imeni Sergo Ordzhonikidze

[Text] A pneumatic acoustical signal radiator, containing a cylindrical high pressure chamber with an output aperture and a guide cylinder with an electric control valve is distinguished by the fact that to increase the economy of operation, it is equipped with a delivery chamber made in the form of a cup and mated at its open end to the high pressure chamber installed coaxially with the delivery chamber and made so that it can perform reciprocating motion; the external end surface of the delivery chamber carries spring-loaded hinged blades, and an airfeed element with a blade is built into the base.

USSR UDC 662.76-404.1

DEVELOPMENT AND INVESTIGATION OF THE PORTABLE HEATING UNIT FOR AIRPORT STRENGTH TESTING OF AVIATION STRUCTURAL ELEMENTS

Saratov V. SB. RASPREDELENIYE I SZHIGANIYE GASA [Collection of Works: Distribution and Combustion of Gas] in Russian 1975 No 1, pp 35-40

[From REFERATIVNYY ZHURNAL TEPLOENERGETIKA No 11, 1976 Abstract No 11T162 by Yu. A. Mironova]

PODIN, A. K., MALAYA, E. M., CHARYEV, A. B., BIRGIN, V. I., and MALYANOV, A. P.

[Text] The following characteristics of the high temperature gas heating element are established: 1) power of the radiant heat flux $\geq$ 300 kilowatts/m^2; 2) temperature of the radiating surface on radiation into an open space 1300°C, for the installation in front of the shield radiator, to 1600°C; 3) the radiator operates stably in the propane consumption range from 1.1 to 2.5 m^3/hr; 4) the emergence in the regime is realized after 15 to 17 minutes, beginning with the time of ignition of the gas-air mixture. The heating elements are installed on the moving brackets by means of which the heating elements assume the shape of the objects heated by them. The devices comprise the motor tank trucks with liquefied gas, the gas regulating station mounted in the closed truck and the heating element which is placed on the closed truck in dismantled form. Illustrations 3; References 1.

USSR UDC 532.57+532.137+536.51+532.14.08+531.787

INVESTIGATIONS OF TOTAL PRESSURE RECEIVERS WITH A CHANNEL AT NUMBERS M = 6 AND 8 AND LARGE ANGLES OF TAPER OF THE STREAM

UCHENIYE ZAPISKI TSENTRAL'NOGO AEROGIDRODINAMICHESKOGO INSTITUTA [Scientific Annals of the Central Aerohydrodynamic Institute] in Russian Vol 7, No 1, 1976 pp 112-116

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1276 by resume]

PETUNIN, A. N.

[text] The author derived the characteristics of sensitivity of two total pressure receiver designs with a channel to stream tapers obtained at numbers M = 6 and 8 and angles of stream taper of $|\beta| \leq 40° - 50°$. The author demonstrates that the error in determining the M number with the aid of the examined receivers does not exceed $\pm 1\%$ for $|\beta| \leq 25°$ in the case M = 6 and when $|\beta| \leq 20°$ in the case M = 8.

USSR UDC 533.697

TESTS OF A MODEL OF A CONVERGENT AIR INTAKE WITH A COMPUTED MACH NUMBER OF 4 IN THE RANGE OF MACH NUMBERS AND ANGLES OF ATTACK

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 231-233

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1150 by N. A. Kolesnikova]

GUTOV, B. I., and ZATOLOKA, V. V.

[Text] The authors present the results of an experimental investigation of two models of supersonic air intakes, which are sector notches with angles of φ = 180° and 90° from a conical flow θ_1 = 10°, $M_{n.r}$ = 4 ($M_{n.r}$ is the computed value of the Mach number of the approaching stream). The models were tested for M_n = 1.75-5 at angles of attack of α = -3° - 15°. Analysis of the obtained experimental data of the shadow photographs permitted making the following conclusions: 1. They realize the supersonic flow on the segment of internal compression (in the stream of internal compression) and supersonic inflow to the channel in the computed regime M_n = 4, α = 0°. 2. The size of the angle φ_2 strongly influences the character of the streamlining of the model with M_n less than $M_{n.r}$: streamlining at φ_2 = 90° is significantly more favorable than when φ_2 = 180°. With φ_2 = 180° the nonseparation range of angles of attack is no less than α = -3° - 15°; the leading wave in front of the input to the channel of the air intake for all M_n less than $M_{n.r}$ is quite near the input to the channel. With φ_2 = 180° for α greater than 9° a separation in flow arises into the channel and the leading wave for M_n less than $M_{n.r}$ is established far in front of the input to the channel; 3. The measured distribution of static pressure along the conical surface in the plane of symmetry of the model with φ_2 = 90° when M_n = 4 agrees well with the computed value computed by allowing for the boundary layer. The tests conducted showed that convergent air intake have favorable flow rate characteristics with change in M_n and α both in amount of flow rate and in uniformity of its distribution along the cross section of the input to the channel.

USSR UDC 533.697

TESTS OF A CONVERGENT INPUT DIFFUSOR AT ANGLES OF ATTACK OF 0-12° AT MACH NUMBERS OF 8.4 AND 11

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 228-231

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1148 by N. A. Kolesnikova]

GUTOV, B. I., ZATOLOKA, V. V., and KISEL', G. A.

[Text] The authors present the results of experimental investigations of a model of a convergent input diffusor in a hypersonic impulse wind tunnel with Mach numbers of the approaching stream of M_n = 8.4 and 11. The purpose of the investigations was to determine the influence of increasing the area of the neck F_n with growth in angle of attack on the expansion of the nonseparation range of the angles of attack. The area of the neck was changed between tests by replacing the bearings. In addition, the authors determined the maximally attainable values of the degree of compression of the cross section of entrained jet in these tests $F_{n.r.}/F_n$. Analysis of the obtained experimental data and shadow photographs permitted establishing the following: 1. The convergent input diffusor of the test configuration (φ_2 = 70°) has a nonseparation range of angles of attack no less than 0° - 12° under conditions of increasing the area of the cross section of the neck F_n with increase in α; here the diffusor had a geometric inner compression $F_{n.r0}/F_{in}$ = 7.05, and a geometric total compression $F_{n.r0}$ which was decreased due to increase in F_n over α up to a value no less than 10.5. 2. With M_n = 11 a total compression $F_{n.r}/F_n$ = 30 for α = 0°, $F_{n.r}/F_n$ = 33 for α = 3° and $F_{n.r}/F_n$ = 20 for α = 12° was realized. 3. The Reynolds number Re (computed along the length of the segment of internal compression l_{in} = 213 mm), reached in the tests conducted, Re = (7 - 1.5) x 10^6 for M_n = 8.4 and Re = (4 - 2) x 10^6 for α = 9° - 12°, is found in the region of strong negative influence of decrease in Re on the triggering of the diffusor, and for α = 0° is found already in the region in which the decrease in Re exerts no negative influence on the triggering of the diffusor.

USSR UDC 681.3.01:621.372.5

SUBOPTIMUM LINEAR DIGITAL FILTERS IN DEVICE COMPLEXES

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 10, 1976 pp 44-49 manuscript received 18 Feb 76

IGNATOV, A. A., MAKAROVA. N. V., and RODIONOV, A. G., Leningrad Institute of Aviation Instrument Engineering

[Abstract] In order to reduce computer requirements of Kalman filters the construction of suboptimal linear digital filters with variable coefficients is proposed. Describing the system in terms of spatial state, the algorithm of Vereshkin and Katovnik is used to represent the output signal of the filter, which is considered the value of one component of the state vector. Minimizing error dispersion leads to a system of equations which is solved by calculating the input correlational moments. The equation of complex information processing from two different types of monitors, a wind speed meter and a Doppler speed meter, which corresponds to a stochastic differential equation of the first order, demonstrates that the error dispersion of the suboptimal filter corresponds to that of a Winer or Kalman filter in a steady process, while in a transitional process the suboptimal filter is significantly better than the Winer and similar to the Kalman. In choosing sampling steps both the properties of the useful signal and interference must be considered. Figures 4; References 3: 2 Russian, 1 Western.

USSR UDC 629.78.018.1

ON THE EFFECT OF THE POSITION OF A TERMINAL COMPRESSION SHOCK SYSTEM IN A DIFFUSOR ON THE COEFFICIENT OF PRESSURE RECOVERY IN SUPERSONIC WIND TUNNEL

UCH. ZAP. TSENTR. AERO-GIDRODINAM. IN-TA in Russian 1976 7, No 2, pp 58-66

Moscow REF ZH. 41 RAKETOSTROYENIYE No 11, 1976 #11.41.155

KONOTOP V. A., and TIKHOMIROV, YU. A.

[Text] An experimental study was made of the pressure distribution along the track of a supersonic wind tunnel with two diffusor versions differing in their throat size. An effect was found of throat dimensions and the model in the working section on the limiting position of the terminal compression shock system. The coefficient of diffusor recovery with a smaller throat in tests with the insertion of the large model comes out less than for a diffusor with a large throat. This is due to the fact that the zone of intense pressure increase in the terminal compression

shock system in the diffusor with smaller throat is in the expanding portion of the channel. To realize the advantage of the small-throat diffusor, the temporary (during model insertion) improvement of the aerodynamic shape of the model is proposed. Illustrations 4; References 6.

USSR

UDC 629.78.048.7

ASPECTS OF INSTRUMENT THERMAL CONDITIONS IN A NON-HERMETIC INSTRUMENT COMPARTMENT OF AN AEROSPACE VEHICLE

Moscow KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY in Russian 1976 pp 53-56

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 8, 1976 #9.41.108

MAKSIMOV, G. YU., PYAK, B. N., and TSAREVSKIY, S. N.

[Text] A comparative analysis of thermal conditions in non-hermetic and hermetic instrument compartments is cited. Assurance of thermal conditions of instruments is, in the final analysis, the assurance of prescribed temperatures of the most sensitive or heat-liberating devices. The temperature of heat-liberating devices is defined by the sum of thermal resistances along the instrument-housing-instrument compartment radiator path, and the temperature of the instrument compartment radiator. In instruments located in non-hermetic compartments, transmission of heat from the liberating device to points of attachment of the radiator is done along the walls of the housing; thus in planning devices we must ensure high degrees of absorption (blackness) of its internal surfaces and outer surfaces of plates and components; ensure good thermal contact between components and the chassis,and also between the chassis and housing (e.g. use of epoxy resins with metal filler); to use materials for the chassis which have high coefficients of heat conduction (some grades of ceramics, steatite, etc.); and for housing--aluminum alloys; to use, when necessary, special materials to fill components (e.g. polyurethane foam); to use when possible perpendicular arrangement of chassis plates to the housing.

To ensure removal of heat from the device to the radiating surfaces, all heat-liberating devices should be attached directly to these radiating surfaces. To reduce contact thermal resistance at points of attachment of the devices to the radiators, contacting surfaces should be treated to a purity of no more than ∇4 - ∇5 and compressed to each other at 100-200 kgs/cm^2. The wall of the device facing the radiator and the radiator surface must have high coefficients of emission. Methods of calculation of temperature fields of the radiator are examined.

USSR UDC 629.78.015:533.6.011.55

STUDY OF ACTIVE THERMAL PROTECTION IN HYPERSONIC FLOW PAST BLUNT OBJECTS IN PULSE TUBES

Minsk TEPLOMASSOOBMEN-V. MATERIALY V VSES. KONF. PO TEPLOMASSOOBMENU in Russian Vol 2, 1976 pp 73-80

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.94

BOSHENYATOV, B. V., DRUKER, I. G., TREYER, L. YA., and YAROSLAVTSEV, M. I.

[Text] In thermally stressed sections of the surface of an aircraft (nose, leading edges, interface of shock waves and boundary layer), thermal fluxes are so great that special measures of thermal protection must be taken. Among others we may use ablative coatings, although this also leads to alteration of the shape of the device, and consequently, change in its aerodynamic characteristics; perhaps a more suitable approach is to use active heat protection, e.g. porous or slit injection of gaseous or fluid coolant. Problems arising here are directly related to problems of heat and mass exchange and require theoretical and applied research. The greatest possibilities in this regard are aerophysical devices of short-term action, especially pulse tubes. The characteristics mode time for them is in the tens of milliseconds, and the main property consists of the rapid alteration of flow parameters over time. These pulse tubes differ from shock tubes whose operation time is an order less. The goal of the study, which reflects a certain stage in research, conducted at the Institute of Theoretical and Applied Mechanics of the USSR Academy of Sciences, was to define the possibilities of pulse tubes (as exemplified by the IT-301 ITPM) to solve problems of heat transmission and active heat protection at hypersonic speeds of gas flow and to produce experimental data. The methodological nature of the first stage in research affected the selection of a model as a hemisphere; the simplicity of shape made it possible to easily perform the appropriate calculations, which were done assuming a stationary flow-past and thermal-mass-exchange. A comparison of experimental and theoretical data gave some idea of the reliability of experiment methods and the presence or absence of quasistationary effects under experiment conditions. A model was made up and used in experiments with feed of gaseous and fluid coolant. The question of designing braking temperature sensors in stationary hot gas flows is examined. Illustrations 4; References 2.

USSR UDC 629.78.048.7

REVIEW OF MODERN RADIATION HEAT CONTROL SYSTEMS OF SCIENTIFIC DEVICE COMPARTMENTS IN AEROSPACE VEHICLES

Moscow KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY in Russian 1976 pp 56-63

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #941.107

PYAK, B. N., and TSAREVSKIY, S. N.

[Text] Principles of design of radiation heat control systems of instrument compartments are investigated. A classification of radiation heat control systems is proposed by the author and described therein. Illustrations 7; References 7.

USSR UDC 629.78:681.3.06:658.4

NETWORK PLANNING AND CONTROL SOFTWARE FOR THE M-222 COMPUTER

Moscow KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY in Russian 1976 pp 5-10

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #941.43

KOLOSOVSKAYA, G. F., and KUDRYASHOV, N. N.

[Text] Composition and block-diagram of network planning and control (SPU) subsystem software are examined. Software is the set of programs for the M-222 computer, designed for calculation of network graph parameters. Programs of the set provide error detection in writing network graphs, calculation of time variables (periods of execution of work and time reserves), translation of computer periods into calendar dates, writing of plan-graphs for the business entity and branch-performers, calculation of production costs, construction of multi-theme graphs for the amount of work of the branch and enterprise. Illustration 1; References 3.

USSR UDC 629.78:681.327

HOLOGRAPHIC DERIVED INFORMATION SYSTEM AND ITS USE IN DEVELOPMENT PRACTICE

Moscow KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY in Russian 1976 pp 11-15

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1976 #9.41.42

NOVIKOV, G. P.

[Text] A derived informational system based on a microholographic library systematized according to entries of managerial and staff information of a development section is described. The system provides four modes of operation with the library data fund: visualization, manual entry, typewritten entry, photographic entry. Illustrations 2; References 2.

USSR UDC 531.382

A SINGLE-AXIS GYRO-STABILIZED PLATFORM WITH A PNEUMATIC STABILIZATION CIRCUIT

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 10, 1976 pp 82-85

LYSOV, A. N., and PICHUGOV, V. S., Chelgabinskiy Polytechnic Institute imeni Leninskiy Komsomol

[Abstract] Since electric motors and angle pickoffs do not satisfy high requirements for nonmagnetizability the use of gyro-stabilized platforms with completely pneumatic stabilization circuits is discussed. In these systems the angle pickoff is a jet pipe controlled by a pneumatic discharge actuator. The transducer rotors and jet pipe are considered as two flow chambers with turbulent chokes. The gas flow is assumed to be quasistatic and changes in its state in the chamber are assumed to occur isothermally. These assumptions lead to a system of linear differential equations describing the stabilization which can be used to choose circuit parameters. Figures 2; References 2 (Russian).

USSR UDC 62-506.42

ON THE ACCURACY OF DETERMINING OBJECT ACCELERATION WITH A COMPLETE OR SIMPLIFIED ALGORITHMIC SOLUTION OF THE INVERSE ACCELEROMETER PROBLEM

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 10, 1976 pp 73-78 manuscript received 24 Dec 75

PLOTNIK, P. K., and ALESHKIN, V. V., Saratovskiy Polytechnic Institute

[Abstract] A method for algorithmically compensating for accelerometer error is developed. The sensitive accelerometer elements are considered solid objects with one degree of freedom and the equation of motion is obtained from Euler's equation. The motion of the object is considered given and not depending on the motion of the sensitive elements. The problem is reduced to the inverse problem of accelerometer theory and the solution of a linear algebraic equation, using moments of inertia and Kramer's formula. An airborne computer using this algorithm determines the components of apparent object acceleration more precisely, since cross connection and nonlinear scale errors are essentially absent. Twelve simplified versions of the algorithm are presented and the substitution of a limited number of terms of an exponential series expansion for trigonometric functions is suggested. The use of the algorithms for a given set of parameters with equal moments of inertia for the sensitive elements demonstrated their high degree of accuracy. Figures 2; Tables 1; References 4 (Russian).

USSR UDC 629.78.076.6

THE THREE-DIMENSIONAL MOTION OF AN AXISYMMETRICAL BODY IN NONSTATIONARY FLOW

Kuybyshev TR. KUYBYSHEV. AVIATS. IN-T in Russian 1975 vyp. 77 pp 71-75

Moscow REF. ZH. 41. RAKETOSTROYENIYE No 9, 1977 #9.41.79

ASLANOV, V. S., and BELOKONOV, V. M.

[Text] Three-dimensional motion of a spherical solid body with respect to the center of mass in a nonstationary sphere is investigated. An expression is found for the integral of effect through full elliptical integrals of first, second and third series. Based on this expression, a solution is found in the vague form of a system of nonlinear differential equations which describe the fluctuating motion of a solid. This solution makes it possible to numerically analyze the initial system of equations with much less computer time. References 3.

USSR

UDC 626.822.004.63/65

CAUSES OF DAMAGE TO WATER MAINS

Moscow GIDROTEKHNIKA I MELIORATSIYA in Russian No 11, Nov 76 pp 95-99

CHEREBEDOV, D. N., and KRYAZHEVSKIKH, N. F.

[Abstract] Grouped water mains made of 114-720 mm diameter steel pipes were laid in virgin land in Northern Kazakhstan and Western Siberia. Neither asphalting or cathodic protection can entirely block pipe corrosion: blowholes and, later, flaws appear in the water mains in 5-6 years. Besides actual corrosion, rough handling of pipe during laying and poor installation aggravates the corrosive rate. This kind of poor workmanship causes defects to appear in water mains within days of their initial service. A rarer kind of noncorrosion damage is water hammer, found only infrequently in these mains.

USSR UDC 621.187.12:628.16.067:538.6.001.42

USE OF A SEMIGRADIENT MAGNETIC FIELD FOR CLEANING BOILER WATERS OF STEAM GENERATORS OF IRON OXIDES AND SLIME

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 48, 1975 pp 95-100

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R124 by A. A. Pshemenskiy]

SHEVCHENKO, YE. V., and KIRICHENKO, V. S.

[Text] An electromagnetic filter (EMF) with a productivity of 25 T/hour was tested for cleaning, from boiler water of an average-pressure steam generator (40 kGauss/m^2), slime consisting of Fe_2O_3 (16-31%), SiO_2 (17-9.2%), CaO (23.2-25.6%) and MgO (13.8-10.6%). The coercive force of the slime samples comprised 65 and 89 Oe, which permits carrying the slime to the discharge of magnetostable materials. Drain water with an Fe content from 0.9 to 1.2 mg/kg at a temperature of 70-90°C was fed to the EMF at a rate of 0.13 to 0.4-0.8 m/sec. The magnetic field strength was found to be in the range of $(4-7.4)\cdot10^4$ A/m. The EMF was washed at flow rates of 1.2-1.4 m/sec. Duration of washing was 30-40 sec. Particles from tens of fractions of micrometers and above are held in a ball adapter. No data are given on the Fe trapping coefficient. A new EMF design is proposed in which the slime is removed without diconnecting the EMF from the supply line. Figures 2; References 4.

USSR UDC 621.181.018.77.002.2(47+57)

BOILER AGGREGATES OF THE BIYSK BOILER PLANT FOR SOLID, LIQUID AND GASEOUS FUELS

TRUDY ALTAYSKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Altay Polytechnic Institute] in Russian No 48, 1975 pp 27-29

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R64 by S. G. Dupleva]

DOROZHKOV, A. A.

[Text] In the Ninth Five-Year Plan the Biysk Boiler Plant conducted considerable research on creating a new series of low-power boilers and renovation of auxiliary boiler equipment. Projects were developed and prototypes of multifuel boilers of the KYe type were produced with a

steam productivity of 25, 35 and 10 T/hour, as well as projects of gas-black oil boilers with a steam productivity of 4, 6, 5, 10, 16, 25, 35, 50 and 75 T/hour and type Ye-16-14 NGM gas-black oil boilers in a steel cladding. Implementation of a series of DYe gas-tight boilers may be done already by 1975-1976. In 1974 a group of research was completed on the development and implementation into series production of ventilators and type VDN and DN smoke pumps. In the realization of this program on restoring production, in 1976-1977 the economic effect will be more than 54 million rubles.

USSR UDC 621.181.018.78.001.4

SEVERAL QUESTIONS IN THE EXPLOITATION AND REPAIR OF THE TPP-210 BOILER AGGREGATE

Novocherkask TRUDY NOVOCHERKASKOGO POLITEKHNICHESKOGO INSTITUTA [Works of the Novocherkask Polytechnic Institute] in Russian No 329, 1976 pp 93-99

[From REFERATIVNYY ZHURNAL, TEPLOENERGETIKA No 10, 1976 Abstract No 10R62]

TARAVKOV, S. S., PROKSH, A. S., SHUMEYKO, N. N., STEPANOV, V. A., and NIKOLAYEVA, N. P.

[Text] The authors give the results of a test of a two-hull boiler aggregate TPP-210 of an energy block of 300 MW. The fuel is anthracite dust. They give recommendations on increasing the reliability and economy of operation of the boiler aggregates under exploitational conditions. Figures 3; Table 1; Reference 1.

USSR UDC 531.781:539.32

COMPLEX OF MEASURING AND REGISTERING APPARATUS FOR PRECISE DETERMINATION OF THE LOGARITHMIC DECREMENT AND G MODULUS ON A TORSION PENDULUM

Rostov-na-Donu TRUDY ROSTOV-NA-DONSKOGO INSTITUTA INZHENEROV ZHELEZNO-DOROZHNOGO TRANSPORTA [Works of the Rostov-na-Donu Institute of Railroad Transportation Engineers] in Russian No 123, 1976 pp 27-32

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.330 by P. N. A.]

ASOTOV, A. I.

[Text] The author describes a complex of measuring and registering apparatus intended for precise determination of the logarithmic decrement and modulus on a torsion pendulum in the frequency range of 0.1-5 Hz. In the device the author uses a digital registration of the parameters to be determined of the free damping oscillations of a torsion pendulum; the measurement cycle is fully automated. Figures 4; Reference 1.

USSR UDC 621.319.7:621.8.037.33

MEASUREMENT CHANNEL OF A HIGHLY SENSITIVE ELECTRON INDUCTION DUST COUNTER

Leningrad TRUDY. LENINGRADSKIY INSTITUT AVIATSIONNOGO PRIBOROSTROYENIYA [Works. Leningrad Institute of Aviation Instrument Construction] in Russian No 101, 1975 pp 130-134

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 8, 1976 Abstract No 9.32.823 by V. L. M-B]

YEVDOKIMOV, V. I., POPOV, B. I., and LEONOV, I. I.

[text] The authors give the equivalent circuit of a measurement channel of an electron induction dust counter (EID), developed in the Leningrad Institute of Aviation Instrument Construction, designed for determining the total amount of dust particles suspended in the air. The possibilities of increasing the sensitivity of the EID were due to the improved characteristic of its measurement channel, which consists of an induction measurement chamber, a measurement amplifier and detector, loaded on the indicating (registering) instrument. The amplifier is made fully on microcircuits which ensure a coefficient of amplification up to 100,000 in the frequency band from 25 to 35 Hz. The detector of the measurement circuit of the EID is made on the operation amplifier IUT401B, which permits obtaining a good linearity of its output characteristic in measuring the input signals from 1 to 100 mV. Figures 3; References 2.

USSR UDC 621.317.77

PRECISION PHASOMETER OF INFRALOW FREQUENCIES OPERATING BY THE TIME-POTENTIAL METHOD

Krasnoyarsk NAUCHNOYE PRIBOROSTROYENIYE DLYA FIZICHESKIKH ISSLEDOVANII [Scientific Instrument Construction for Physical Investigations, Cal Collection of Works] in Russian, Part 1, 1975 pp 183-186

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.965]

ANEPIR, A. A., and KRAVCHENKO, S. A.

[Text] The authors reveal the method of measuring the angle of shift of phases by converting the phase shift to a constant stress using an integrator. They show that the error in the phasometer does not exceed 0.5° with a resolving power in the frequency range from 0.001 to 5 Hz. Figure 1; Reference 1.

USSR UDC 539.1.074.3

INVESTIGATION OF THE NOISE CHARACTERISTICS OF AN X-RAY DETECTOR ON THE BASIS OF THE FEU-87 WITH AN ORGANIC SCINTILLATOR

Trudy SOYUZNOGO NII PRIBOROSTROYENIYA [Works of the Union Scientific Research Institute of Instrument Construction] in Russian No 30-31, 1976 pp 69-73

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 9, 1976 Abstract No 9.32.1155 by resume]

KARMANOVA, A. P., and STEPANOV, YE. YE.

[Text] The authors investigate the noise characteristics of a scintillation detector, consisting of a plastic scintillator and FEU-87. Study of the dependence of counting rate of impulses from the PM at various thresholds of registration with a source and without allows selecting the optimal one from the viewpoint of the signal-to-noise ratio and registration threshold. As the source they used the nuclide ^{241}Am with an energy of the gamma quanta of 59 keV. In the course of the experiment the authors measured the effectiveness of quanta registration. Figures 2; Table 1; References 3.

USSR UDC 531.717.082.32:621.9

MEANS FOR EXPANSION OF THE LIMITS OF MEASUREMENT OF PNEUMATIC DEVICES

TR. NII METROL. VYSSH. UCHEB. ZAVEDENIY in Russian No 8, 1976 pp 128-135

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.343 from the resume]

POLYANSKIY, P. M., GOPAL, S., and DEMIDENKO, G. M.

[Text] A study is made of certain means for expansion of the limits of measurement of pneumatic devices for active testing using "nozzle-flag" systems. The design of the MAMI-3 device is described, created on the basis of a special measuring bracket with two measuring systems, the first of which is used for rough, the second--for precise measurement. A schematic diagram of the device used to change the mechanical transfer ratio in active testing instruments is presented. A detailed study is presented of the new pneumatic system of the MAMI with extended range of measurement (up to 600 μm), allowing the required sensitivity to be produced over the entire range of clearances by changing the ordinary characteristic of the "nozzle-flap" system. Figures 7; References 6.

USSR UDC 621.35:621.38.019.3

ELECTROCHEMICAL CONTINUOUS READING INTEGRATOR FOR OPERATION IN A BROAD TEMPERATURE RANGE

Moscow V. SB. KONSTRUIROVANIYE NAUCH. KOSMICH. APPARATURY [Collection: Construction of Scientific Space Equipment] in Russian, NAUKA PRESS, 1976 pp 211-216

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.140]

SOROKINA, A. P., and SHAVRONSKAYA, A. V.

[Text] A study is made of the electrochemical continuous reading integrator in which dimethylformamide is used as the electrolyte solvent for expansion of the operating temperature range from -50 to +60°C. On the basis of the experimental data relations were obtained for the basic parameters of the indicator as a function of temperature, and the nature of their variation was established.

USSR UDC 531.781.2:539.3(088.8)

DEVICE FOR MEASURING DEFORMATION

Moscow [KUYBYSHEV AVIATS. IN-T] [Kuybhshev Aviation Institute], AVT. SV. SSSR, KL. [USSR Author's Certificate] No 483570, Claimed 7 Aug 73, No 1955710, published 22 Dec 75 in Russian

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.434]

BEL'KOV, V. N., KOMPANEN, V. K., RAYKOV, B. K., and SKOBELEV, O. P.

[Text] A device is proposed for measuring deformations containing a power supply, strain gages, a controlled inductance, the displacement winding of which with an adjustable resistor is connected to the power supply, the trigger, the count pulse generator and counter. In order to increase the sensitivity and precision of the measurements and simplify the circuitry, the device is equipped with an electronic switch by means of which the operating winding and the different ends of the controlled inductance control windings are connected to the power supply; the other ends of the control windings are connected to the strain gages operating on tension and compression, the standard resistance and the comparator connected to the operating controlled inductance winding, the cycle pulse generator connected to one input of the tripper, the other input of the latter is connected to the comparator and the selector included between the outputs of the count pulse generator and the trigger connected to the electronic switch in the output of the counter.

USSR UDC 535.241.16

RESULTS OF THE DEVELOPMENT AND TESTING OF AN OPTICAL STEP ATTENUATOR

Moscow V SB. FOTOMETRICH. METODY I ANNARATURA DLYA ISSLED. V IK-DIAPAZONE [Collection of Works: Photometric Methods and Equipment for Research in the Infrared Range] in Russian 1976 pp 53-56

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1275]

GORYUNOVA, T. D., ZYABREV, B. G., MAMAKINA, S. V., RUKMAN, G. I., SHALOMEYEVA, N. V., and SHELEMAN, YE. V.

[Text] The results are presented from the development and testing of an attenuator with digitally variable attenuation coefficient from 1.08 to

$2.3 \cdot 10^5$. It is reported that on replacement of the attenuation coefficient no disturbance of the adjustment of the attenuator occurred, and the dependence of the attenuation coefficient on the polarization of the incident radiation did not arise. It was noted that the results of the laboratory measurements are in good correspondence to theory within the limits of error of the calibration system used.

The developed attenuator permits sufficiently simple variation of the attenuation coefficient in large dynamic and spectral ranges.

USSR UDC 539.164.07:536.621

APPLICATION OF THE CALVET TYPE MICROCALORIMETER TO DETERMINE THE ACTIVITY OF CLOSED ALPHA SOURCES

Moscow V. SB. METODY IZMERENIY I ISPYTANIY ZAKRYTYKH ISTOCHNIKOV IONIZIRUYUSHCH IZLUCHENIY [Collection of Works: Methods of Measurement and Testing of Closed Sources of Ionizing Radiation] in Russian, Atomizdat, 1976 pp 136-137

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1401]

ARKHIPOV, V. A., DOBRETSOV, V. N., USTINOV, V. A., and FEDOROV, V. V.

[Text] The described microcalorimeter operates in combination with the highly sensitive measuring equipment--the F-118 nanovoltammeter and the N-352 pen recorder. It is calibrated within the power range of 10^{-5} to 5 watts. Using the microcalorimeter, a large number of measurements were made of the activity of various alpha sources (^{239}Pu, ^{237}Np, ^{232}Th, and so on). The microcalorimeter permits measurement of the activity of the sources from 300 microcuries and more and the source measurement time of 10 to 15 minutes.

USSR UDC 539.63 + 539.58 + 550.32

MEASUREMENT OF SPEED OF SOUND IN SHOCK-COMPRESSED QUARTZITE, DOLOMITE, ANHYDRITE, SODIUM CHLORIDE, PARAFFIN, PLEXIGLAS, POLYETHYLENE, AND TEFLON

Novosibirsk ZHURNAL PRIKLADNOY MEKHANIKI I TEKHNICHESKOY FIZIKI in Russian No 5, 1976 pp 136-139 manuscript received 24 Oct 75

PAVLOVSKIY, M. N., Moscow

[Abstract] The speed of sound is an important thermodynamic parameter for determining the state of a compressed material. In this paper the results

are given of experimental measurements of the speed of expansion waves in shock-compressed quartzite, dolomite, anhydrite, monocrystalline NaCl, paraffin, plexiglas, polyethylene, and teflon by means of a manganin pressure gage described in an earlier paper. This gage is a sinusoid of manganin foil 0.05 mm thick, which is cemented by means of epoxy resin between the interfaces of the test specimen. A voltage pulse is fed to the gage via copper leads a few microseconds before a shock wave arrives. The change in voltage in the gage's leads which occurs as the result of the change in the gage's resistance during shock loading and in the expansion wave is recorded with an oscillograph. The test specimen is compressed with a plane shock wave formed as the result of detonating an explosive. A contact pickup placed on the free surface of the specimen is used to obtain a time mark on the oscillogram, indicating the moment the shock wave reaches this surface. The values of wave velocities measured by means of the manganin pressure gage proved to be in good agreement with experimental data obtained by various other methods, such as magnetoelectric technics. Comparative results for the materials studied are given in tabular form. The results demonstrate that using a manganin pressure gage makes it possible to make reliable measurements of the speed of sound in nonmetals in the area of comparatively low pressure (100 to 300 kbar), i.e., in the area in which the use of other methods of measurement are unsuitable for various reasons. The advantage of the method described here is that it is possible to make a direct and independent determination in each individual experiment of the speed of sound, wave velocity, and pressure at the same time. Figures 2; Tables 1; References 9 (Russian).

USSR UDC 620.179.141.3

A FLAW DETECTOR WITH REMOTE SENSOR FOR CHECKING PUMP RODS

TRUDY UFIMSKOGO AVIATSIONNOGO INSTITUTA [Transactions of Ufa Aviation Institute] in Russian No 79, 1974 pp 236-239

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.217]

OKRUSHKO, YE. I.

[Text] Brief descriptions are given of a flaw detector with a flip coil located inside a magnetizing solenoid, and the disadvantages of using it for finding defects. The paper describes a rod flaw detector designed for checking rods directly under industrial conditions. Figures 3; References 3.

USSR UDC 620.178.7(088.8)

AN INDUCTIVE IMPACT VELOCITY SENSOR FOR IMPACT TESTS OF NONFERROMAGNETIC MATERIALS

USSR AUTHOR'S CERTIFICATE No 490013, filed 17 Jan 74, published 30 Mar 76 in Russian

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.469P]

ZARIPOV, M. F., VAKHITOVA, KH. Z., KHABIROV, R. G., and NIKOLAYEV, A. N., Ufa Aviation Institute, Bashkir Affiliate of the Academy of Sciences USSR

[Text] The moving element in the proposed sensor is a block of nonferromagnetic material on which a thin layer of foil is applied. The device also contains field and measurement windings. To simplify the design, the foil is applied in the form of a closed loop of electrically conductive material, and the field and measurement coils are wound on a two-pole magnetic circuit.

USSR UDC 551.508.7.08

THE GA-1 AUTOMATIC DEW POINT HYGROMETER

Moscow PROMYSLOVAYA I ZAVODSKAYA OBRABOTKA PRIRODNOGO GAZA [Industrial and Plant Processing of Natural Gas, Collection of Papers] in Russian 1976 pp 63-72

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.1099 by V. S. K.]

KARPOV, A. K., KAREVSKIY, V. P., and SUCHKOV, A. M.

[Text] The paper gives the general appearance, a diagram of the head, an electrical diagram, a description of the design and the technical specifications of an electric dew point hygrometer developed at the All-Union Scientific Research Institute of Natural Gas. The instrument is used to determine the moisture content of gas and the concentration of hydrocarbons in gases. The dew point measurement range is from +20 to -20°C, and measurement error is ± 1°C; maximum permissible gas pressure 100 kgf/cm^2; hygrometer line voltage supply 220 $\pm$ 20 V; power consumption no more than 100 W. The hygrometer has the following advantages: total automation of the dew point measurement process, universality of the instrument and possibility of using under field conditions, and preparation time of 3-5 minutes means that the device can be used for quick checks. Figures 4; References 5.

USSR

UDC 539.125.5.03

PRECISION METHODS OF MEASURING THE TOTAL FLUX OF FAST NEUTRONS OF RADIO-ISOTOPE NEUTRON SOURCES

Moscow METODY IZMERENIY I ISPYTANIY ZAKRYTYKH ISTOCHNIKOV IONIZIRUYUSHCHIKH IZLUCHENIY [Methods of Measuring and Testing Enclosed Sources of Ionizing Radiation, Collection of Papers] in Russian, Atomizdat, 1976 pp 116-120

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.1298 by P. N. A.]

YARITSYNA, I. A., SHCHEBOLEV, V. T., STUKOV, G. M., FOMINYKH, S. I., and MIGUN'KOV, O. A.

[Text] A report on a unit neutron flux State standard developed at the All-Union Scientific Research Intitute of Metrology imeni D. I. Mendelev. The standard includes three installations that utilize the methods of accompanying particles, manganese bath and gold activation. The first installation determines the neutron flux within 1.4% from sources in the range of 10^4-10^9 neutrons/s, the second installation provides measurements within 0.8% in the range of 10^5-10^9 neutrons/s, and the third installation gives measurements with an eror of 0.8-1% in the range of 10^5-10^9 neutrons/s. The standard installations are used to certify sets of isotope neutron sources and photoneutron source on the level of working neutron flux unit standards. The OVS-3 all-wave counter designed by the All-Union Scientific Research Institute of Metrology is used to transmit the standard neutron flux unit. The three reference standard installations have taken part in international comparisons conducted in the program of the International Bureau of Weights and Measures. References 11.

USSR

UDC 531.14.082.52/.54.083.92

INVESTIGATION OF SCANNING COMPENSATION INTERPOLATORS OF PRECISE PHOTOELECTRIC RASTER AND INTERFERENCE DEVICES

Moscow PRIMENENIYE OPTIKO-ELEKTRONNYKH PRIBOROV V KONTROL'NO-IZMERITEL'NOY TEKHNIKE [Use of Electro-Optical Instruments in Monitoring and Measurement Equipment, Collection of Papers] in Russian 1976 pp 82-87

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.290 by P. N. A.]

YANUSHKIN, V. N.

[Text] To improve the resolution of instruments for precision measurement of displacements there is the possibility of interpolating in the spacing of

measures that have a periodic structure such as line scales, metrological rasters, and half-wavelengths of light. The Moscow Higher Technical School imeni Bauman has developed a number of instruments and pilot models of digital measurement systems with interpolation that use a null method of measurement with compensation balancing of a length by a length. The system is made up of two modules: a measurement head and a conversion channel. The measurement head contains the following elements: a source of radiant energy, a measurement coupling, a photocell, and a scanning compensation interpolator. The conversion channel contains: an amplifier, a synchronous detector, a null indicator, a reversible pulse counter, a decoder with digital display, a code-to-voltage converter, an oscillator, and a phase shifter. The system has an output to a digital printer and a computer. The working principle of null measurement systems is examined on the example of a raster system. The method of structural analysis is used to study the structure and makeup of the static null error measurement systems. It is shown that the static error is determined chiefly by the errors of the scanning compensation interpolator and the code-to-voltage converter, which are connected in the feedback circuit of the system. Figure 1; References 7.

USSR UDC 539.1.074.8

M-30B THERMALLY STABLE SLOW-NEUTRON DETECTORS

Moscow V. SB. IZOTOPY V SSSR [Collection of Works: Isotopes in the USSR] in Russian, Atomizdat, 1976 No 45, pp 25-28

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1414]

CHERNIKOV, V. V., TSIRLIN, YU. A., SOLOMONOV, V. M., ZAGRIY, L. B., and GRES', N. V.

[Text] A description is presented of the new combination scintillation slow neutron detectors based on phosphors containing ^{10}B and ZnS (Ag) with light guides made of optical glass. The detectors have an instrument efficiency of recording of slow neutrons of approximately 30 to 40 percent. The calculated detector characteristics in the detection unit with the FEU-74A photomultiplier are presented for the temperature range from -130 to +150°C. Illustrations 3; References 7.

USSR UDC 532.57+532.137+536.51+532.14.08+531.787

TENSOMETRIC GAUGE OF ATMOSPHERIC PRESSURE TIAD-326

Novosibirsk AEROFIZICHESKIYE ISSLEDOVANIYA [Aerophysical Investigations, Collection of Works] in Russian No 5, 1975 pp 321-313

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8B1275 by M. I. Vinogradov]

OMELAYEV, A. I.

[Text] The atmospheric pressure is perceived by a sylphon bellows inside which is ensured a vacuum no lower than 10^{-2} mm Hg. Ninety-five percent of the atmopsheric pressure compressing the sylphon bellows is perceived by the compensation load by means of thrust, and 5% by an elastic beam with four tensoresistors fastened on it, connected to a bridge circuit. The measurement range may be shifted to the side of higher or lower pressure by selection of the compensating load. A comparatively high stability of the instrument is ensured by the fact that the elastic element and the sylphon bellows are loaded only when the measurements are made. The sensitivity of the sensor is 200 microvolts/mm Hg, the basic reduced error of measurement at $15 \pm 10°$ is no more than 0.04%, the resistance of the tensoelements is $100\ \Omega$, and the measurement range is 730-770 mm Hg.

USSR UDC 535.8

AN ELECTRONIC-OPTICAL DEVICE FOR MEASURING TWIST

Leningrad IZVESTIYA VUZOV PRIBOROSTROYENIYE in Russian Vol 19, No 8, 1976 pp 98-102 manuscript received 1 Oct 75

MUSYAKOV, V. L., and PANKOV, E. D., Leningrad Institute of Exact Mechanics and Optics

[Abstract] A simplified electronic-optical device for measuring twisting angles is described. The device, based on a two-channel collimator consisting of two sources and two polarizers, one for each object, whose axes are perpendicular to each other, has a transducer which measures the changes in relative phase of radient flow. The radiation reaching the transducer element is expressed as the integral of the product of transmission coefficients and spectral brightness and leads to an equation for threshold sensitivity as inversely proportional to this integral. The function of the device was verified on an experimental model and shown to be linear in the plus or minus 1° range without a voltage transformer,

and in the plus or minus 40" range with a transformer. Sensitivity was 8" compared to 4" calculated theoretically. Figures 2; References 7: 6 Russian, 1 Western.

USSR UDC 629.7.054.03

ON THE QUESTION OF DIAGNOSTIC EFFECTIVENESS OF THE ON-BOARD VIBRO-APPARATUS IV-300 ON THE AI-25 ENGINE

Kiev NADEZHNOST' I DOLGOVECHNOST' AVIATSIONNYKH GAZOTURBINNYKH DVIGATELYEY [Reliability and Liftime of Aviation Gas-Turbine Engines, Collection of Works] in Russian No 2, 1975 pp 63-66

[From REFERATIVNYY ZHURNAL, AVIATSIONNYYE I RAKETNYYE DVIGATELI No 8, 1976 Abstract No 8.34.92 resume]

PALLEY, Z. S., and SLUTSKIN, S. A.

[Text] The authors cite the results of an investigation of the diagnostic effectiveness of a regular on-board vibroapparatus IV-300 on the AI-25 engine. It was demonstrated that the apparatus registers only eight significant defects in rotor parts. To increase the sensitivity of the vibroapparatus the authors recommend investigating the operation of the system with the vibroconverters placed directly in the supports and implementation of a holding unit in the circuit. Tables 3.

USSR UDC 535.231:536.52

INVESTIGATION OF THE INFLUENCE OF NONUNIFORMITY OF THE TEMPERATURE FIELD OF THE RADIATOR OF A WORKING STANDARD OF THE TEMPERATURE UNIT ACCORDING TO THE SCALE OF INTEGRAL RADIATION IN THE RANGE OF 300-600°K ON ITS RADIATION

TRUDY METROLOGICHESKIKH INSTITUTOV SSSR. VNII METROLOGII [Works of the Metrological Institute of the USSR. All-Union Scientific Research Institute of Metrology] in Russian No 183(243), 1975 pp 46-52

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA NO 9, 1976 Abstract No 9.32.674]

IVENSKIY, S. N.

[Text] The author describes a method of monitoring the temperature distribution in the cavity of a low-temperature radiator of large

geometrical dimensions, and also an experimental method of determining the influence of nonuniformity of the temperature field of the radiator cavity on its radiation. The author gives the limiting requirements of nonuniformity of the temperature field of the radiator cavity as a function of the error of the verifiable pyrometer of total radiation. Reference 1.

USSR

UDC 531.717.85.082.32

AN INSTRUMENT FOR TESTING NONSTRAIGHTNESS OF THE GENERATRICES OF PRECISION PARTS

TR. NII METROL. VYSSH. UCHEB. ZAVEDENIY in Russian 1976 No 8, pp 119-127

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.397 from the resume]

KOMAROV, B. F., KUROCHKIN, A. P., and MITAUER, V. B.

[Text] Rigid requirements are placed on the form of parts which make up precision joints. Thus, the tolerance for nonlinearity of the generatrix of a plunger is a fraction of a micrometer. The Office of Interchangeability has developed an instrument for testing the linearity of such parts, the BV-6065, in which linear movement of the part being tested is assured by a stage carried by an aerostatic bearing. The stroke of the stage is 150 mm, variation in path from linear not over 0.1 μm. Variation from linearity of the part being tested is checked by a contact pneumatic method. The results of measurement are read on the scale of a pneumatic-optical instrument or recorded on a pneumatic recorder. References 4.

USSR

UDC 531.768.082.73

MINIATURE MATCHING TYPE SU AMPLIFIERS

VIBRATSION. TEKHNIKA in Russian Moscow 1976 pp 31-36

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.582 by P. N. A.]

GRIGORENKO, N. I., MIKHAYLOV, P. K., and SAZONOV, V. A.

[Text] A set of miniature matching amplifiers has been developed, used to study mechanical processes on moving objects and intended for matching the

outputs of piezoaccelerometers to the inputs of radiotelemetry devices which transmit data to recorders. The set consists of four instruments: the SU-3-0.9 (three-channel amplifier with high impedance inputs); SU-2-0.9 (two-channel amplifier with high impedance input); SU-1-0.9 (one-channel amplifier with high impedance input); SU-1-30 (one-channel amplifier with high impedance input and gain factor variable from 1 to 30). Schematic diagrams of the amplifiers are presented. All instruments are based on the series-produced 200 842 microcircuit using suspended elements. Our supply is by a single 6.3 V source of voltage. Results are presented from electric, mechanical and climatic testing of the amplifiers. Figures 2; Table 1; Reference 1.

USSR UDC 531.768.082.73

MICROMINIATURE MATCHING AMPLIFIERS WITH PIEZOELECTRIC ACCELEROMETERS

VIBRATSION. TEKHNIKA in Russian Moscow 1976 pp 37-41

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 12, 1976 Abstract No 12.32.583 by P. N. A.]

DAVYDOV, G. V., SEMENOV, A. S., and TERESHCHUK, K. M.

[Text] Versions are suggested for circuit and design-technological solutions of a matching amplifier with an input impedance of at least 1 GΩ, providing for stable operation in the temperature range of -50 to +50 C. The transmission factor in the transmission band is 0.95-1.00 with a nonlinearity of the amplitude-frequency characteristic in the transmission band of ±3% and attenuation of 5-6 dB per octave. The transmission bands of the amplifiers are (GHz): 0.5-125; 0.5-250; 0.5-500; 0.5-1000; 0.5-2000; 0.5-5000; 0.5-10,000; 0.5-20,000. The amplifiers are made in the form of plug-in units and are placed in metal-glass bodies with volumes of not over 1 cm^3. Figures 2; References 5.

USSR UDC 620.17

ON A PROCEDURE OF TESTING ELASTOMERS IN THE COMPLEX STRESSED STATE

Moscow VSESOYUZNYY NAUCHNO-TEKHNICHESKIY SIMPOZIUM "METODY I TEKHNIKA EKSPERIMENTAL'NYKH ISSLEDOVANII MEKHANICHESKIKH SVOYSTV PLASTMASS". TEZISY DOKLADOV [All-Union Scientific-Technical Symposium "Methods and Technique of Experimental Investigations of the Mechanical Properties of Plastics". Texts of the Reports, Collection of Works] in Russian 1976 pp 112-113

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V1453 by I. M. Kershteyn]

KOSINENKO, I. I., and SANNIKOV, L. S.

[Text] The authors present brief technical data on a device for investigating the deformation properties of low-modulus rubber-like polyer systems under conditions of the complex stressed state. The device permits making tests of thin-wall hollow samples in a broad temperature range at various speeds of axial tension (from 1 to 5000 mm/min) and torsion (from 0.001 to 0.1 rad/sec). It also allows loading with an internal pressure up to 10 kg/cm^2. Measurement of the components of the loads and shifts was done by a special system of sensors with registration on two-coordinate potentiometers in the coordinates measured size versus time. The authors predict the possibility of making tests in the creep regime at constant values of the axial load, the torque and internal pressure, applied "instantaneously" or for a finite period of time.

USSR UDC 543.275.3:535.361

THE PROBABLE PATHS FOR IMPROVEMENT OF THE SENSITIVITY OF THE PHOTOELECTRIC AEROSOL CONTROL DEVICES

Kiev V. SB. SOVREM. PROBL. RAZVITIYA ANALIT. PRIBOROSTR. [Collection of Works: Modern Problems of the Development of Analytical Instrumentmaking] in Russian 1976 pp 40-51

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1026]

FILIPPOV, V. P., KURENEV, YU. P., LARCHENKO V. I., RAINKINA, YE. A., and BULGAKOV, A. Z.

[Text] A study is made of the basic schematic diagrams for the construction of dust control instruments; an analysis is made of the investigated

instruments and their significant deficiencies are indicated. The means of eliminating these deficiencies permitting essential improvement in the instrument characteristics are indicated. It is noted that the application of the method of internal sounding of the suspended particles in the laser resonator and the method using the conversion of the polarization radiation offers the possibility of creating the class of instruments of improved accuracy and sensitivity. Illustrations 6; Table 1; References 9.

USSR UDC 551.508.7

SOME PROBLEMS OF THE KINETICS OF THE GENERATION OF A NEW PHASE IN HEATED ELECTROLYTIC MOISTURE GAGES

Moscow TR. NII GIDROMETEOROL. PRIBOROSTR. [Works of the Scientific Research Institute of Hydrometeorological Instruments] in Russian 1976 No 33, p 10

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1048]

KOCHETOV, S. M., NIKONOVA, V. V., and CHERNOV, V. T.

[Text] A study is made of the effect of the frequency of electric field on the magnitude of the recooling required for generating the $LiCl \cdot 2H_2O$ crystallization centers. It is demonstrated that the superheating of the electrolyte to 70 and more degrees with respect to the temperature of the four-phase equilibrium ($LiCl \cdot 2H_2O$ - $LiCl \cdot H_2O$--solution--vapor) leads to an increase in the supercooling. The experimentally obtained relations indicate the significant effect of the electromagnetic field frequency after the introduction of the undissolved impurities in the activated and unactivated states. Experimental curves are presented which indicate the effect of the deactivation of the impurity on the frequency dependence of the magnitude of the metastable zone of existence of the $LiCl \cdot H_2O$ monohydrate. Illustrations 2; References 14.

USSR UDC 543.087.92:681.332

A CHEMOTRON DIFFUSION INTEGRATOR

PRIBORY I SISTEMY UPRAVLENIYA in Russian No 6, 1976 pp 44-45

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.135 by P. N. A.]

DI, R. I., POSTNIKOV, V. S., and MARKOV, V. N.

[Text] The paper gives the design, manufacturing specifics and principal characteristics of a chemotron diffusion integrator developed by the Chirchik Affiliate of the Experimental Design Office of Automation. This chemotron diffusion integrator integrates slowly varying and constant electrochemical signals from different primary measurement converters and stores the results of integration in memory for a certain length of time. The described integrator can be used in circuits for integrating the signal of a coulometric cell, chromatograph sensors, etc. i.e. anywhere that integral evaluation is required for DC or infralow-frequency signals. Figure 1; References 6.

USSR UDC 620.178.53(088.8)

A DEVICE FOR REPRODUCING RANDOM VIBRATIONS

USSR AUTHOR'S CERTIFICATE No 504957, filed 8 May 73, published 22 Apr 76 in Russian

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.468P]

GAVRILOV, A. N., DAVIDOV, A. R., and LOS'YEV, B. M., Moscow Aviation Institute

[Text] A device is proposed for reproducing random vibrations that contains a random signal generator, a vibrostand with amplifier, a vibration sensor, a feedback device, a spectrum selector and an amplifier with AGC. To simplify the device and reduce cost, the random signal generator is made in the form of a looped magnetic tape with record, playback and erase heads in a series arrangement, and the feedback device is made in the form of a series circuit containing a spectrum analyzer with discrete frequency scanning, a first selector switch, the spectrum selector, and a second selector switch that is connected to the controlling input of the amplifier with AGC. The main input of the device is connected

to the output of a bandpass filter with discrete frequency synchronization, and the output of the device is connected to one of the inputs of an adder. The second input of this adder is connected to the playback head and to the bandpass filter input, and the adder output is connected to the record head.

USSR UDC 539.1.03

INFLUENCE THAT THE MATERIAL OF SUBSTRATES AND PROTECTIVE COATINGS HAS ON THE SPECTRAL-ANGULAR CHARACTERISTICS OF SOURCES OF LOW-ENERGY ELECTRONS

Moscow METODY IZMERENIY I ISPYTANIY ZAKRYTYKH ISTOCHNIKOV IONIZIRUYUSHCHIKH IZLUCHENIY [Methods of Measuring and Testing Enclosed Sources of Ionzing Radiation, Collection of Papers] in Russian, Atomizdat, 1976 pp 250-259

[From REFERATIVNYY ZHURNAL, METROLOGIYA I IZMERITEL'NAYA TEKHNIKA No 11, 1976 Abstract No 11.32.1404 by P. N. A.]

SMIRNOV, V. V., and SHALOTENKO, K. N.

[Text] A method is developed for studying backscattering and transmission of low-energy electrons (1-150 keV) through layers of materials as applicable to the characteristics of radioisotopic electron sources. An iron-free 270° spectrometer is designed and investigated with a uniform magnetic field. This spectrometer is constructed on the retron principle, and can be used to study the spectra of electrons with energy from a few keV to 150 keV in the angle range of 0-90°. Experimental studies of backscattering of monoenergetic electrons were done on substrates of aluminum, stainless steel and tungsten 1 mm thick. The experimental data are given. Figures 4.

USSR UDC 539.165.03

STUDY OF THE RADIATION-PHYSICAL CHARACTERISTICS OF INTENSE BETA-RADIATION SOURCES BASED ON ^{90}Sr

Moscow V. SB. METODY IZMERENIY I ISPYTANIY ZAKRYTYKH ISTOCHNIKOV IONIZIRUYUSHCH IZLUCHENIY [Collection of Works: Methods of Measurement and Testing of Closed Sources of Ionizing Radiation] in Russian, Atomizdat, 1976, pp 269-285

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1403]

TERENT'YEV, B. M., OSIPOV, V. B., KUMIROV, A. L., PLYUSHCH, O. P., and MAMIN, YE. B.

[Text] The spectral-angular distributions of the beta radiation of the IRUS-2 source with activity of 25 coulombs, the spectral distribution of the bremsstrahlung of the IRUS type, the spectrometric study of the energy losses, beta and bremsstrahlung of the IRUS type sources on transmission through tissue equivalent materials, the basic radiation-physical characteristics of the rod sources, a description of the laboratory device with beta radiation sources based on ^{20}Sr, and a description of the experimental industrial device with an extended beta irradiator for obtaining polyacrylamide are presented. Illustrations 10; References 12.

USSR UDC 531.756:543.46:778.38.087

RECORDING THE VARIATIONS IN DENSITY OF A STRATIFIED LIQUID USING HOLOGRAPHIC INTERFEROMETER

Moscow V. SB. GOLOGR. METODY I ANNARATURA, PRIMENYAYEMAYA V FIZ. ISSLED. [Collection of Works: Holographic Methods and Equipment Used in Physical Research] in Russian 1976 pp 25-26

[From REFERATIVNYY ZHURNAL 32, METROLOGIYA I IZMERITAL'NAYA TEKHNIKA No 10, 1976 Abstract No 10.32.1082]

GURAL', T. I., YERSHOV, O. A., SORITS, A. G., and FOMENKO, B. A.

[Text] The use of the UIG-1 holographic device by the method of two-exposure holographic interferometry of the phase objects for recording variations of the density of a stratified liquid is discussed. The holograms were recorded on FPGV-2 photographic film. The dimensions of the holographically recorded scene are 120 x 120 x 170. The interferograms were recorded in

the bands of infinite and finite width; the latter were created by the introduction of a wedge between exposures. The density disturbances of the liquid (two or several layers of aqueous solutions of different salinity) were created by a ball floating in it. Illustrations 4.

USSR UDC 624.131+539.215

ON THE PROCEDURE OF EXPERIMENTAL INVESTIGATIONS OF MODELS OF SHEET PILE FOUNDATIONS WITH IMITATION OF SEISMIC LOADS BY MICROEXPLOSIONS

Perm' SBORNIK NAUCHNYKH TRUDOV. PERM'SKIY POLITEKHNICHESKIY INSTITUT [Collection of Scientific Works. Perm' Polytechnic Institute] in Russian No 159, 1975 pp 112-116

[From REFERATIVNYY ZHURNAL, MEKHANIKA No 8, 1976 Abstract No 8V863 by V. N. Kostyuchenko]

DZHANUZAKOV, B. B.

[Text] The author gives a description of a model device for testing the foundation pile for the action of seismic loads. The model tests were conducted in a trough of dimensions 1.5 x 7 m in plan and 1.4 m in height. The ratio of dimensions of the model and the actual was taken at 1:10. For excitation of the oscillations in the soil (sand or sandy loam), filling the trough electrodetonators were used. Registration of the oscillations was done with the aid of type SPED-56 M accelerometers and tensometers. References 5.

USSR UDC 629.78.018.3

THERMOPHYSICAL DEVICES TO STUDY THE PROBLEM OF THERMAL PROTECTION

Moscow AEROMEKHANIKA in Russian 1976 pp 248-252

Moscow REF ZH 41. RAKETOSTROYENIYE No 11, 1976 #11.41.165

KUTS, S. M.

[Text] An experimental device for the study of efficient means of thermal protection of linear accelerators with cryogenic fuel, and the primary facets of experimental research methods are described. Experimental and theoretical research was done to evaluate the contribution of three

different constituents to the integral process of heat transfer--radiation heat conductivity, heat conductivity through the solid frame of screen-vacuum heat insulation (SVHI) and thermal conductivity of rarified gas. Research results of thermal conductivity of SVHI at temperatures ranging from 77 to 800°K are examined. The effect of reducing SVHI heat conductivity after heat and neutron treatment is described. Illustrations 5; References 4.

USSR UDC 778.3

THE SFR-US HIGH-SPEED ULTRAVIOLET CAMERA

Moscow ZHURNAL NAUCHNOY I PRIKLADNOY FOTOGRAFII I KINEMATOGRAFII in Russian Vol 21, No 6, Nov/Dec 76 pp 446-449 manuscript received 15 Mar 76

DUBOVIK, A. S., BELINSKAYA, G. I., and CHERNOVA, T. I., All-Union Scientific Research Institute of Physical Optics Measurements

[Abstract] This paper describes the SFR-US high-speed ultraviolet camera for taking multiple frames and chronophotographs in visible and UV light at wavelengths from 0.2 to 0.7 μm. The camera contains special devices for spectral measurements throughout this wavelength range. The working principles in multiple-frame and chronophotograph operation are explained. In multiple-frame operation the image is reflected by a rapidly rotating mirror through a series of focusing lenses onto the film, which is held in the focal arc of these lenses. In this mode, the frame diameter is 10 mm, and the total number of frames is 44. Focal length is 60 mm, relative aperture 1:12, field of view 9°30', resolution 25 lines/mm, speed from $25 \cdot 10^3$ to $440 \cdot 10^3$ frames per second and focusing range from 2 meters to infinity. In the chronophotograph mode, a slit cuts off a strip of the focused image, which is then reflected by the mirror directly onto the film. As the mirror rotates, the strip image is scanned over the film. The frame size in this mode is 375x25 mm, and time resolution is 10^{-8} s. Focal length is 400 mm, relative aperture 1:15, field of view 3°9', resolution 20 lines/mm, scanning speed from 150 to 3750 m/s and focusing range from 2 meters to infinity. In addition, spectrometric attachments can be used in this mode to print a simultaneous spectrum on the film in three ultraviolet bands (220-280, 280-340 and 340-350 nm) and in the visible region (400-700 nm). Figures 3; References 1 (Russian).

USSR UDC 528.722.6

A DEVICE FOR RESOLVING DRIVE MOTION INTO TWO MUTUALLY PERPENDICULAR COMPONENTS

Moscow OTKRYTIYA, IZOBRETENIYA, PROMYSHLENNYYE OBRAZTSY, TOVARNYYE ZNAKI in Russian No 40, 30 Oct 76 p 110 Author's Certificate No 533819 filed 8 May 74

DROBYSHEV, F. V., Moscow Institute of Engineers of Geodesy, Aerial Photography and Cartography

[Text] This Author's Certificate introduces: 1. A device for resolving drive motion into two mutually perpendicular components in sine-cosine

relation, in particular for controlling the drive wheels of a universal stereophotogrammetric camera. The device contains a common electric drive, preferably with a speed control system, and a common controlling element that sets the direction of motion when it interacts with differential gear trains. The planet wheels of these gear trains are connected to the driven elements (specifically the drive wheels of the camera), and the driving rollers of the gear trains are connected to rotating disks driven from the common motor. As a distinguishing feature of the patent, the device is simplified by arranging the rotating disks in a single plane and placing them on one of two carriages that move in mutually perpendicular directions, by fastening one of the differential mechanisms on the other carriage and by making the controlling element in the form of a pin that fits into slots cut through both carriages. 2. A modification of this device distinguished by the fact that the planet wheel of the differential that interacts with the disk on the moving carriage is in direct contact with one of the drive wheels of the camera, while the planet wheel of the other differential is connected through a Cardan shaft to the other control wheel.

USSR

UDC 662.997.004.14:621.362

INVESTIGATION OF THE USEFUL-LIFE STABILITY OF LOW-TEMPERATURE THERMOPILES

Tashkent GELIOTEKHNIKA in Russian No 5, 1976 pp 6-11 manuscript received 20 May 75

DUDKIN, L. D., MARKMAN, M. A., and SOKOLOVA, V. M., All-Union "Order of the Red Banner of Labor" Scientific Research Institute of Sources of Current

[Russian abstract provided by the source]

[Text] The authors present the results of tests of different kinds of low-temperature thermopiles in air and in an inert atmosphere; these tests were undertaken to determine factors that limit useful life, and to find ways to make these thermopiles last longer. Either $Bi_2(Te, Se)_3$ or PbTe was used in the n-arm of the thermopiles; $(Bi, Sb)_2Te_3$ was used in the p-arm in both cases. Cobalt was used for commutation of the "hot" junction.

The reason for failure of the thermopiles with operation in air is oxidation of the materials both at the cobalt interface and on grain boundaries in the region adjacent to the hot junction.

In tests in an inert atmosphere the diffusion layer formed between the material in the p-arm and the material of the "hot" commutation bus reduces the strength of a thermocouple, leading to fracture with heat cycling with a resultant stepwise increase in internal resistance. The useful-life stability of low-temperature thermopiles depends both on the temperature of the "hot" junction and on the thermocouple geometry.

Figures 5; References 4 Russian.

USSR UDC 621.016.4:629.02

STUDY OF THERMAL STRESS OF A MAZ-537 MOTOR VEHICLE TRANSMISSION

Moscow IZVESTIYA VYSSHIKH UCHEVNYKH ZAVEDENIY MASHINOSTROYENIYE in Russian No 8, 1976 pp 103-108 manuscript received 25 Jul 75

TEREKHOV, A. S., and NEKRASOV, V. I., Kurgan Machine-building Institute

[Abstract] A study is made of the thermal state of the transmission units of a specific vehicle, the MAZ-537, both on the road and on the test stand. The road testing was performed in areas with tropical and hot climate, with air temperatures as high as 40 C in the shade. The thermal modes of all four driving axles, the gearbox and overdrive were studied under all load conditions from zero to the maximum rated load. The experiments showed that the temperature modes of the drive train elements are extremely highly stressed under hot weather conditions, oil temperatures rising to as great as 160 C. Methods of reducing oil temperatures, including thinning of drive train parts and the use of an oil radiator, are discussed. References 3.

USSR UDC 629.113.011.2

INVESTIGATION OF FRAME VIBRATIONS OF THE 'URAL-377' THREE-AXLE TRUCK

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 11, Nov 76 pp 27-28

KUZNETSOV, P. F., and NAYDANOV, I. A., Ural Motor Vehicle Plant

[Abstract] Tests were done to determine the cause of longitudinal vibrations of the frame and body of the "Ural-377" three-axle truck. The truck carried vibration measuring equipment with linear frequency characteristic in the 0-15 Hz range. Vertical accelerations were measured at the front shock absorber, under the cab, and under the bed. Longitudinal accelerations of the cab were measured on the level of the driver's head. The measurement section was a cobblestone surface 300 m long over which the truck was driven at 40 and 50 km/hr. In addition, the truck was shaken on a test stand and displacements were measured. The results showed that the frame of the truck is subject to flexural vibrations in the longitudinal vertical plane, which intensifies vibrations of the cab in the longitudinal direction. The frequency of the frame vibrations is commensurate with the frequency of vibrations of masses that are not spring-mounted. Increasing the rigidity of the frame reduces the amplitude of the flexural vibrations under working conditions with an appreciable reduction in the intensity of vibrations of the cab in the longitudinal direction. Figures 3; Table 1; References 3 (Russian).

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